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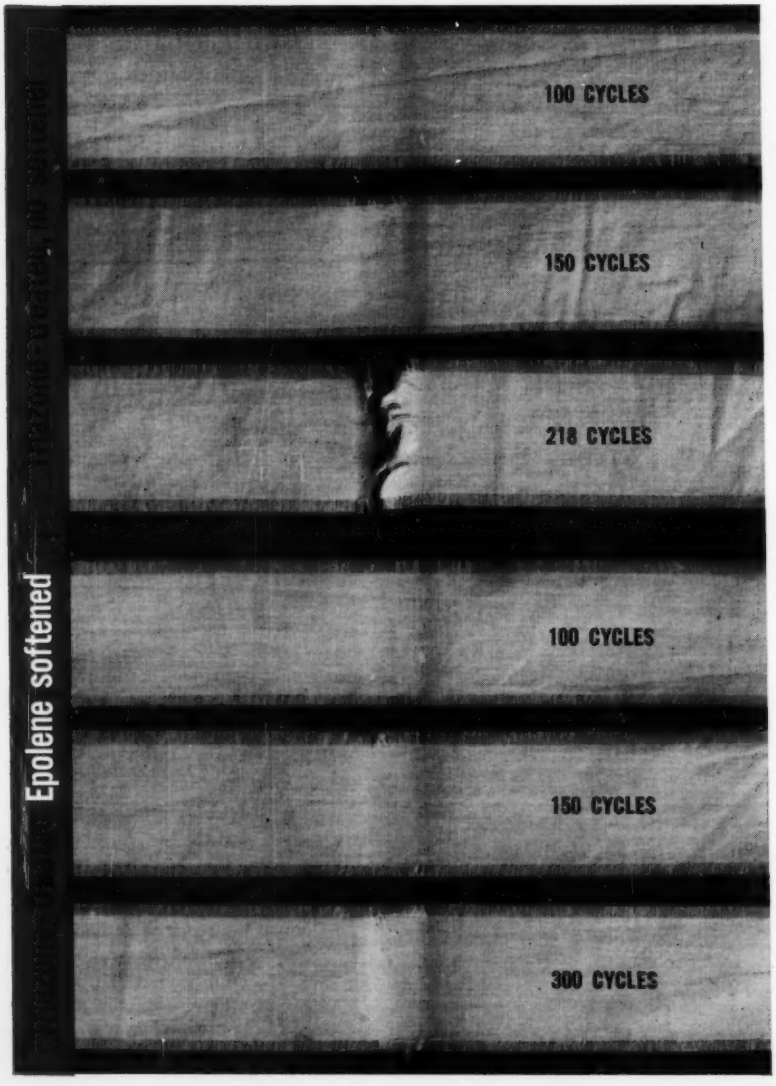
The Stoll-Flex Abrasion Test demonstrates the increased strength given to a resin-treated cotton fabric by an Epolene softener.



IT is axiomatic in the textile industry that the finishing resin alone does not a wash-and-wear fabric make. In fact, the variables are many, and often complex.

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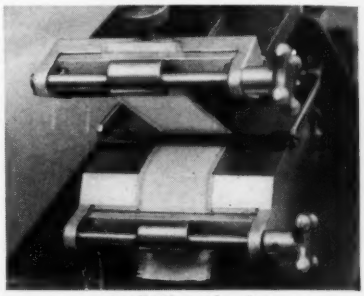

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HOW MUCH ABOUT PENGUINS?

A TOPIC of interest to both publishers and readers is discussed in the April issue of *Materials Research and Standards*, Bulletin of the ASTM. It is introduced by an ancedote concerning a little girl who had been given a book about penguins and then asked for her opinion about it. She replied, "This is a very good book, but it tells me more about penguins than I want to know."

To publish every last detail, particularly complete tables, of a technical report is undoubtedly desired by some who would feel that it were incomplete without them. But this brings up the problem of space, which every publisher faces. To expand a publication to enable it to carry all of the minute details, and still publish as many articles, is an expensive proposition and makes the publication more time-consuming to read and cumbersome to handle. The majority of readers, we feel, would prefer to see the tables in a condensed form or in the form of a graph.

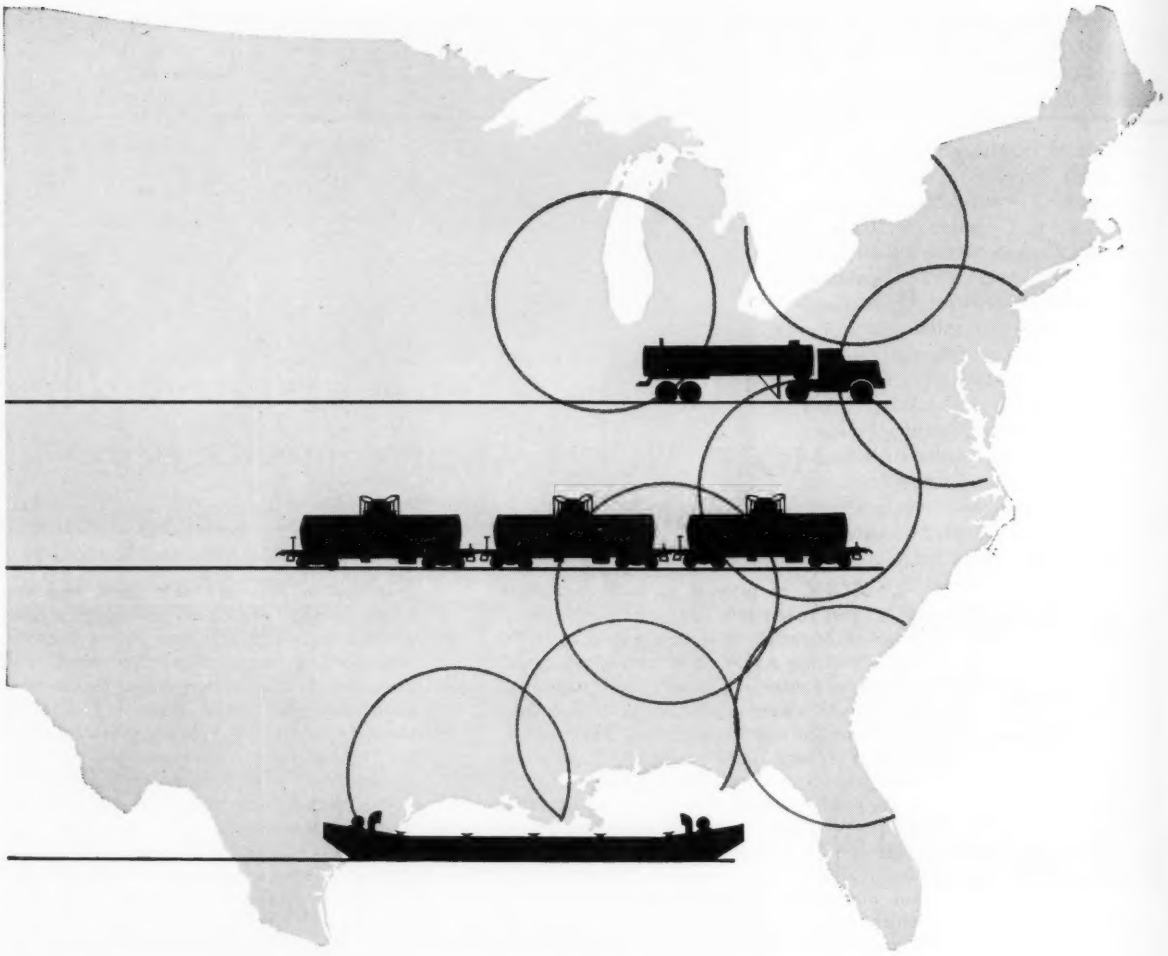
The problem was considered by the ASTM at a recent meeting of its Administrative Committee on Papers and Publications and the following recommendation, as cited in the Bulletin, was evolved:

"In order to reduce publication costs without compromising the author's intentions, it should be a general policy, for technical papers containing extensive tabulations, and except where statistical studies are being made, that the data be given primarily in graphical or summary-table form, and that substantiating tables be supplied to reviewers and discussers and kept in the Society's files for no more than five years and discarded if inquiries during that period have been negligible. It is presumed that the summary tables will indicate the number of tests involved for an average and the philosophy used in arriving at the summation."

This method of handling the problem might be feasible for some publishers but for many it would not and, in effect, would possibly impose upon the time and patience of both the reader and the publisher. However the recommendation seems to have merit and, with modifications, might be adapted to each individual publisher's peculiar requirements. We mentioned previously that it was our opinion that the majority of readers would prefer the use of condensed tables in a published version of a technical report but this is, of course, only an assumption. Where condensed tables are used, the reader is free to contact the author if he wishes to pursue the subject further. At the same time, the reader may feel that he should not be called upon to do this.

It boils down to a question of the busy reader's time and the space available to the publisher. Would you prefer to see more papers with the tables in a condensed version or fewer papers complete to the last detail?

We would like your views.



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DEVOTED EXCLUSIVELY TO TEXTILE WET PROCESSING

ADR

Specially Contributed

A STUDY OF HYPOCHLORITE-RESISTANT MELAMINE-TYPE FINISHES*

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The commercial "wash-and-wear" and wrinkle-resistance finishing agents for cotton fabrics based on melamine-formaldehyde products are widely used but many suffer the disadvantage that the treated fabrics yellow noticeably when washed using hypochlorite bleach. This problem has been studied and the cause of yellowing of fabrics treated with melamine-type agents has been attributed to the reaction of hypochlorite with primary amino groups in the finished fabric. Exclusion of these groups and elimination of the yellowing was accomplished by placing stable substituents, methyl or 2-hydroxyethyl groups, on each amino nitrogen of the s-triazine ring before reaction with formaldehyde. The properties of the fabrics treated with the formaldehyde reaction product of acetoguanamine, N,N-bis(2-hydroxyethyl) melamine, N,N'-dimethyl-N",N"-bis-(2-hydroxyethyl) melamine and N,N,'N"-trimethylmelamine are presented and compared with those of fabrics treated with some commercial methylolmelamines and methylated methylolmelamines. The preparation of these melamines and some of their properties are also described.

INTRODUCTION

FINISHING agents for producing "wash-and-wear" or wrinkle-resistant cotton fabrics based on melamine-formaldehyde products are among the oldest used commercially. According to the literature, many different amino-s-triazines have been prepared and suggested as possibilities for the production of improved wrinkle-resistant fabrics. However, only those methylol amino-s-triazines based on melamine have gained wide usage in the industry. The methylolmelamines as such, or as blends, are widely used with colored fabrics in this country and with white and colored fabrics in Europe. Fabrics finished with methylolmelamines presently used will yellow to some extent when bleached in hypochlorite. Therefore, white fabrics finished with methylolmelamines have not gained widespread favor in this country. This yellowing can be removed from the fabrics by using sodium hydrosulfite solutions; however, the yellowing returns with repeated washes in hypochlorite. The other properties of the finish, such as durability, production of high wrinkle resistance, and avoidance of strength losses from retained chlorine of treated fabrics, are very good and are responsible for the continued use of these agents.

Yellowing by hypochlorite bleach is thought to result from a reaction of chlorine with the amino group of the melamine molecule. Indeed, it is known that yellowing is decreased by increasing methylolation (hydroxymethylation) and subsequent methylation. Thus, methylated methylolmelamine finished fabric yellows less than methylolmelamine finished fabrics; and a methylated, highly methylolated melamine finished fabric yellows less than the methylated methylolmelamine finished fabric. Figure 1 illustrates this concept; however, pure compounds are seldom encountered.

The properties of a wrinkle-resistant fabric obtained by the use of these agents are generally accepted to result from the crosslinking of cellulosic fibers as illustrated in Figure 2 and as qualified below. In actual practice, it is likely that most or part of the agent reacts with only one or two cellulose molecules. Also, the

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[1]One of the laboratories of the Southern Utilization Research and Development Division, Agricultural Research Service, U S Department of Agriculture.

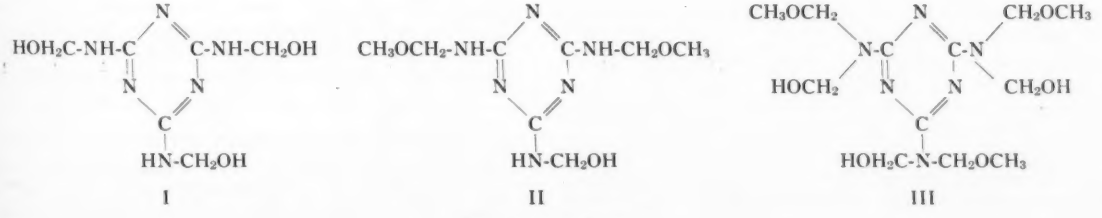

Figure 1
Yellowing of agents based on melamine

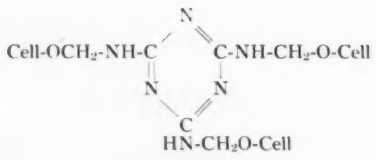

Figure 2
Crosslinks theoretically possible with trimethylolmelamines and cellulose

remaining amino hydrogens in Figure 2 may be replaced by methylol or methylated methylol groups which in turn may or may not react with cellulose. Polymerization of the agent during curing is expected also, which makes it a difficult task to describe accurately the structure of the modified cellulose. Incomplete reaction plus loss of methylol groups and subsequent hydrolysis of the linkages to cellulose undoubtedly result in a scattering of free >NH and $-NH_2$ groups throughout the finished fabric. It was expected that either one or both of these groups are responsible for the yellowing properties of melamine finishes.

Since the procedure of methylation and methylolation has not produced a nonyellowing finish, various derivatives of melamine have been synthesized and applied to fabrics to establish the role of >NH and $-NH_2$ groups in the yellowing of melamine finishes. Then, melamine types were prepared which did not yellow.

EXPERIMENTAL PROCEDURES

The amino-s-triazines shown in Figure 3 and used in this work are acetoguanamine (A), N,N-bis(2-hydroxyethyl)melamine (B), N,N'-dimethyl-N",N"-bis(2-hydroxyethyl)melamine (C), and N,N',N"-trimethylmelamine (D). The structures shown in Figure 3 are in the amide form although tautomeric equilibria probably exist as illustrated in Figure 4.

The amino-s-triazines A,B, and D have been mentioned previously in the literature, but C is believed to be a new compound. The melting points and nitrogen analysis of compound B are recorded in this work because these data were not found in the literature. The nitrogen values were determined by the Kjeldahl method.

All percentages are by weight unless noted otherwise.

I) SOURCE OF AMINO-S-TRIAZINES——

A) *Acetoguanamine.* This was obtained from a commercial source.

B) *N,N-bis(2-hydroxyethyl)melamine.* This compound was prepared from cyanuric chloride by the use of general procedures found in the literature (*1, 2*). Crystals from ethanol melted 199-202°C. N Theory = 39.23%, N Found = 38.94%.

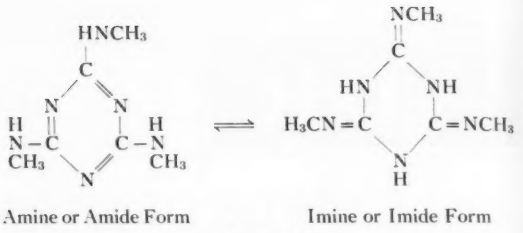

Figure 4
Tautomeric equilibria possible for N,N',N"-trimethylmelamine

C) *N,N'-dimethyl-N",N"-bis(2-hydroxyethyl) melamine.* The intermediate 2,4-dimethylamino-6-chloro-s-triazine was prepared from cyanuric chloride as described in the literature (*1*). To 0.2 moles of the wet intermediate were added 300 ml of the monoethylether of ethyleneglycol and 0.4 moles of diethanolamine. The solution was refluxed four to five hours. Concentration of the solution precipitated the desired product, which was further purified by crystallization from water or ethanol. The dry crystals melted at 135-137°C. N Theory = 34.69%, N Found = 34.64%.

D) *N,N'N"-trimethylmelamine.* This compound was prepared by using general procedures found in the literature (*2*). A large excess of methylamine was used in the procedures to make up for the amine lost by volatilization. After the solids were dissolved, anhydrous potassium carbonate was added to the solution until an oil phase was obtained. This oil was removed from the solution and crystallized from a benzene-petroleum ether mixture. Solids melting at 129-130°C. were obtained with some difficulty. Melting point from the literature (*3*) is 130°C.

II) METHYLOLATION OF AMINO-S-TRIAZINES ——The methylol derivatives of the above amino-s-triazines were prepared by treatment with 37% aqueous formaldehyde, in the molar ratios and at the concentration indicated in Tables I and II, by the following procedures:

A) *Acetoguanamine.* Neither this compound nor the methylol derivative is very soluble in water at room temperature. The methylol derivative, therefore, was applied in a lower concentration than the other agents. Also, the solution had to be prepared and padded onto the fabric quickly to prevent precipitation. Two or four moles of aqueous formaldehyde were added to one mole of acetoguanamine and the pH adjusted to 8 with 1% sodium hydroxide. At this pH the mixture, containing 90% water, was heated with stirring for two hours at 50-70°C. The solution was then cooled, the catalyst added, and the fabric padded immediately.

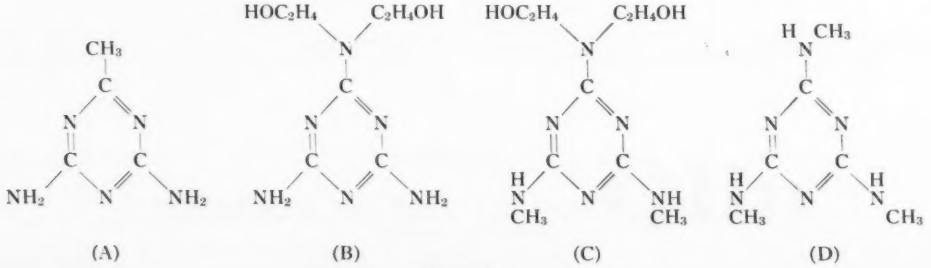

Figure 3
Amino-s-triazines used in this work

B) *N,N-bis(2-hydroxyethyl)melamine.* This solution was prepared by mixing the formaldehyde and the melamine in an aqueous solution, adjusting the pH to 8 with 1% sodium hydroxide, warming to rapidly dissolve solids, and allowing the solution to stand overnight. The solution was used the next day to pad the fabrics.

C) *N,N'-dimethyl-N",N"-bis(2-hydroxyethyl) melamine.* A methylol derivative prepared using the procedure outlined in B gave treated fabrics a boardy hand and poor crease recovery, indicating prepolymerization of the agent. Therefore, the methylol derivative was prepared by dissolving the melamine in hot water, cooling to 45°C, adding the formaldehyde, and adjusting the pH to 8. This solution was reheated to 45°C and allowed to cool slowly to room temperature. After one hour the solution plus the catalyst was used to pad the fabric. Within four hours after padding the padding solution contained precipitated solids.

D) *N,N',N"-trimethylmelamine.* This compound is quite soluble in water and forms alkaline solution even after mixing with the formaldehyde solution. The methylol derivative was prepared by two procedures:

1) The procedure outlined in B was followed, but only one drop of dilute (1%) sodium hydroxide was used in a 50-gram solution. This produced a pH of about 9. After several hours the solution became cloudy and additional sodium hydroxide was added. The cloudy solution was left standing overnight. The insoluble portion was filtered off the next day reducing the solids content from 11% to 9.5% and the filtrate was used as before.

2) The reactants were mixed as before and a drop of 1% sodium hydroxide added. The solution was heated at 50-60°C for 30 minutes and then water added to restore original weight. After the solution cooled to room temperature, the catalyst was added and the solution, 11% solids, was used immediately. Soon after padding a precipitate formed in the solution.

III) METHYLATION——The methylation of the methylol derivatives of N,N-bis(2-hydroxyethyl)melamine was carried out in methanol with oxalic acid as a catalyst (*4*).

IV) FABRIC TREATMENT——After the agents were prepared, as outlined above, they were adjusted with water to the indicated concentrations. Catalysts were added to the solutions just prior to padding.

The fabric used in these investigations was an 80 × 80 cotton print cloth which had been desized, caustic boiled, and bleached. Padding was done with squeeze rolls using two dips and two nips at a roll-pressure to give about 80% wet add-on. The wet fabric was pinned on frames at its original dimension, and dried eight minutes at 70-80°C, and cured three minutes at 160°C, unless noted otherwise, in ovens with circulating air. After curing, all fabrics were washed with a nonionic detergent in a slightly alkaline solution and tumble dried. Fabrics were air-equilibrated at least four hours before approximate add-ons were determined.

V) EVALUATION OF FINISHED TEXTILES——Breaking strength of the fabric samples was determined on strips raveled to 80 threads by the procedure described by ASTM (*5a*), wrinkle resistance by the Monsanto crease recovery method (*5b*), and tearing strength by the Elmendorf method (*5c*). Resistance to chlorine damage was determined by the AATCC "scorch test" procedure (*6*).

For determination of yellowing from hypochlorite bleaching, the treated fabrics were washed by a procedure that would be used in home laundering with hypochlorite. This was performed in a home-type, automatic washer using conditions recommended for cotton fabrics (130-140°F with a 15-minute wash cycle), not the less severe conditions recommended for some "wash-and-wear" fabrics. The wash water for the wash cycle contained hypochlorite to give 0.02% available chlorine and a normal amount of a commercial detergent. Between washings, the fabrics were dried in a tumble drier at medium heat.

The degree of yellowing of the treated fabric was measured after two wash cycles if yellowing was clearly evident at that time. Otherwise, the degree of yellowing was determined after 10 wash cycles. A Hunter Multi-Purpose Reflectometer[2] with the blue filter was used for this purpose. The instrument was standardized frequently using the porcelain-enameled, working-standard panels of the National Bureau of Standards. Readings were taken on fabrics folded to a thickness of four layers. Fabrics with reflectance readings of 79% are only very slightly yellow and the color is not easily seen unless compared with a white fabric. The lower the reflectance reading the more yellow the fabric. Those fabrics with a reflectance reading of 81% do not appear yellow compared with a white fabric. The reflectance reading of untreated fabric was 81%.

RESULTS

The properties of cotton print cloth treated with the substituted melamine derivatives and acetoguanamine derivatives, using various catalyst systems, are presented in Tables I and II, as are the properties of these fabrics after two, 10, or 20 home washes with hypochlorite bleach. Since there is little or no information in the literature concerning the agents in Tables I and II, the properties of each are discussed separately below.

Table III contains data on fabrics finished with various commercial melamine derivatives. The yellowing of these finishes from hypochlorite bleaching is shown in the table and agrees with the comments made in the Introduction.

ACETOGUANAMINE——The use of N-methylol derivatives of this amino-s-triazine is mentioned in the literature but little or no attention is directed towards its use as a "wash-and-wear" agent. Because of the low solubility of the acetoguanamine and the methylol derivatives, the agent would be difficult to use commercially. Yellowing on washing in hypochlorite is developed after only two washings. Also, it was noted that, on standing, the intensity of the color increased on that portion of the yellowed fabric directly exposed to the light and the atmosphere.

N,N-BIS(2-HYDROXYETHYL)MELAMINE ——The use of N-methylol derivatives of this material in producing "wash-and-wear" fabrics is mentioned in the literature (*7*), but no data are given on fabrics treated with this agent. The solubility and stability of the melamine and the methylol derivatives derived from it appear to be excellent from the standpoint of possible usage in a commerical operation. However, as is shown in Table I, yellowing is not completely eliminated by high methylolation even on subsequent methylation. The zinc nitrate plus hydrochloric acid catalyst appeared to give the best results with this finish.

[2]The mention of trade names and firms in this paper does not imply their endorsement by the Department of Agriculture over other similar products or firms not mentioned.

TABLE I

Properties of fabrics finished with some methylol amino-s-triazines

No.	Treating Solution: Moles HCHO	Treating Solution: Triazine in solution[1] (%)	Treating Solution: Catalyst[2]	Approx add-on (%)	Fabric Properties: Before laundering: Crease recovery W+F (deg)	Before laundering: Tearing strength W+F (gms)	Before laundering: Breaking strength W (lbs)	Before laundering: Breaking strength after chlorination "scorch test" (% of original)	After laundering: No. of washes	After laundering: Reflectance (%)	After laundering: Crease recovery W+F (deg)
			Acetoguanamine derivatives								
1	2	6.8	c	6.7	246	880	39.1	95	2	75	—
2	4	6.8	c	5.9	269	760	—	—	2	75	—
			N,N-Bis(2-hydroxyethyl)melamine dervatives								
3	2	9.4	a	7.0	268	980	37.0	106	2	73	—
4	2	9.4	c	7.3	263	980	40.4	94	2	65	—
5	2	9.4	d	7.4	252	1014	41.9	94	2	68	—
6	4	9.4	a	9.4	298	760	—	—	10	78	277
7	4[3]	9.4	a	7.8	285	913	—	—	10	78	270
			N,N'-Dimethyl-N",N"-bis(2-hydroxyethyl)melamine derivatives								
8	2	9.4	a	5.1	238	1053	—	—	10	81	189
9	2	9.4	b	6.4	245	913	37.5	103	10	81	208
			N,N',N"-Trimethylmelamine derivatives								
10	3	5	b	6.6	284	800	37.5	98	10	82	267
11	3	7.2	b	5.9	263	827	37.5	89	10	81	267
			Untreated fabric								
12	—	—	—	—	181	1960	52.1	99	10	81	—

[1] Percentage represents concentration equivalent to triazine only in the pad bath. Hydroxymethylated triazine percentages, therefore, are higher by an amount depending on the moles of formaldehyde used.

[2] Catalysts are as follows (percentages are weight percent of solution): a) 0.7% $Zn(NO_3)_2 \cdot 6H_2O$ + 0.07%HCl; b) 4% $MgCl_2 \cdot 6H_2O$; c) 5% $MgCl_2 \cdot 6H_2O$; and d) 2% of an alkanolamine. HCl, a commercial product manufactured for this purpose.

[3] This finishing agent was also methylated.

[4] This same sample when cured for five minutes instead of three produced a crease recovery angle of 251° and a tear of 887 gms.

[5] The methylol derivative for Run No. 10 was prepared by the first method listed under Section II "Preparation of Finishing Agents." The methylol derivative for Run No. 11 was prepared by the second method.

TABLE II

Properties of fabrics finished with N,N',N"-trimethylmelamine agents varying the formaldehyde content

No.	Treating Solution: Moles HCHO	Treating Solution: Triazine in solution[1] (%)	Treating Solution: Catalyst	Approx add-on (%)	Fabric properties: Before laundering: Crease recovery W+F (deg)	Before laundering: Tearing strength W (gms)	After laundering: Reflectance: 10 washes (%)	After laundering: Reflectance: 20 washes (%)	After laundering: Crease recovery W+F: 10 washes (deg)	After laundering: Crease recovery W+F: 20 washes (deg)
13	1	6	[2]	4.4	228	833	83	—	—	—
14	2	6	[2]	5.3	268	627	82	—	—	—
15	3	6	[2]	5.6	282	593	83	82	261	250

[1] As in Table I, percentage represents concentration equivalent to triazine only in the pad bath. Therefore, assuming complete reaction with HCHO, the agent strengths are 7.1%, 8.1%, 9.2%. The method used to prepare the agents was the second method listed under Section II "Preparation of Finishing Agents."

[2] 4% $MgCl_2 \cdot 6H_2O$

TABLE III

Properties of fabrics treated with some commercial methylolmelamines

No.	Treating solution: Agent type[1]	Treating solution: Catalyst[2]	Approx add-on (%)	Fabric properties: Before laundering: Crease recovery W+F (deg)	Before laundering: Tearing strength W+F (gms)	After laundering: No. of washes	After laundering: Reflectance (%)	After laundering: Crease recovery W+F (deg)
1	I-Methylolmelamine	a	7.9	297	850	2	68	—
2	I-Methylolmelamine	b	8.7	286	860	2	68	—
3	II-Methylated methylolmelamine	b	6.4	286	872	10	75	275
4	III-Methylated methylolmelamine	a	4.5	304	763	10	79	—
5	III-Methylated methylolmelamine	b	5.3	293	767	10	79	278

[1] Commercial finishing agents believed to resemble the agents shown in Figure 1 were used in aqueous solution with 11-12% solids present.

[2] Catalysts are as follows (percentages are weight percent of solution): a) 0.7% $Zn(NO_3)_2 \cdot 6H_2O$ + 0.07% HCl; b) 4% $MgCl_2 \cdot 6H_2O$.

N,N'-DIMETHYL-N",N"-BIS(2-HYDROXYETHYL) MELAMINE——This melamine is believed to be a new compound and, therefore, the use of its N-methylol derivatives are unknown. This agent has the advantage of having an acceptable solubility in water and forming methylol derivatives which are also soluble. However, in the presence of the acidic catalyst the agent appears to polymerize or precipitate easily on standing. Only moderate crease recovery angles are obtained with this agent (251° after a five-minute cure at 160°C); however, the finished fabric is not yellowed during the home washes with bleach. The loss of crease recovery during the home washes is disappointing and difficult to explain since the nitrogen content of the finished fabric after the 10 washes was 1.92% compared with 2.12% originally.

N,N',N"-TRIMETHYLMELAMINE——This melamine has been reported in the literature but apparently no attempt has been made to use it in "wash-and-wear" finishes. The melamine is quite soluble; however, the methylol derivatives polymerize or precipitate easily. The data in Tables I and II indicate that a fabric with excellent wrinkle resistance is obtained with this agent. Also, the finished fabric is not yellowed during the home washes with bleach.

DISCUSSION

From consideration of these results on the whole, it would seem that the melamines have much to offer to the "wash-and-wear" finisher. These finishes are not only durable and resist chlorine damage but can also be nonyellowing when bleached with hyochlorite.

The data in Tables I, II, and III indicate that yellowing of melamine finishes on hypochlorite bleaching is due to the reaction of the primary amino groups and is not caused by reaction with secondary amino groups containing only one active hydrogen. The primary amino group in the commercial melamine preparations and the agents from acetoguanamine and N,N-bis(2-hydroxyethyl)melamine can come from several sources: 1) insufficient methylol substitution; 2) loss of methylol or methylated methylol groups before reaction with cellulose is achieved; 3) loss of methylol or methylated methylol groups that remain because of incomplete reaction with cellulose; and 4) hydrolysis of ether link to cellulose.

The improvement obtained by methylation of methylolmelamines is due to increased resistance to hydrolysis of the etherified methylol group over the free methylol group. This stability apparently is not sufficient to prevent gradual hydrolytic removal on laundering leaving free primary amino groups to cause yellowing. By substituting each amino nitrogen with an alkyl group, which group is more stable during washing or curing, only secondary amino groups are available to the chlorine. It is shown in Tables I and II that fabrics treated with agents based on N-substituted melamine, namely N,N′-dimethyl-N″,N″-bis(2-hydroxyethyl)melamine and N,N′,N″-trimethylmelamine are nonyellowing when washed in hypochlorite bleach. This is true even when the agent was prepared from N,N′,N″-trimethylmelamine and less than three moles of formaldehyde. In this manner the presence of secondary amino groups in the fabric is virtually assured. The tertiary amino group is also eliminated as a color former by the results obtained with N,N′-dimethyl-N″,N″-bis(2-hydroxyethyl) melamine. These results agree with the work of Chenicek (8) who concluded that N-monochloroamides are colorless; whereas, the N-dichloro derivatives are yellow. Therefore, complete elimination of actual or potential primary amino groups by placing an alkyl or other stable substituent on each amino nitrogen of the s-triazine before reaction with formaldehyde is necessary to prevent any tendency to hypochlorite yellowing.

The commercial use of stable N-substituted melamine-formaldehyde products for "wash-and-wear" is promising if two problems can be solved. First, the N-substituted melamine must be prepared at a lower price than is now possible. Cyanuric chloride is presently a farily expensive starting material, but large-scale manufacture from hydrogen cyanide and chlorine should reduce its price drastically. Or possibly a preparation from materials other than cyanuric chloride could be developed (3). Secondly, the preparation of stable, soluble methylol derivatives (or possibly methylated methylol derivatives) is necessary so that the agent may be stored and used in the pad bath without precipitation and/or polymerization. At the present time, its use in blends with less expensive agents appears to offer the best possibilities.

Work with other N-substituted melamines and blends of these agents is underway and will be published in a later paper. These results should help to determine the generality of the conclusions reached in this paper.

SUMMARY

Several new N-substituted melamine-formaldehyde products and other amino-s-triazine-formaldehyde products have been prepared and used as finishing agents in producing "wash-and-wear" and wrinkle-resistant cottons to study the yellowing phenomenon caused by hypochlorite. An examination of these fabrics and fabrics treated with commercial melamine finishes indicates that the yellowing from hypochlorite bleach is due to the presence of primary amino groups in the finished fabric. Wrinkle-resistant fabrics have been obtained by treatment with the methylol derivatives of the following melamines, N,N′-dimethyl-N″,N″-bis(2-hydroxyethyl) melamine and N,N′,N″-trimethylmelamine, which do not yellow when washed ten times, and in the case of the latter, twenty times, in the presence of hypochlorite bleach. Although finished fabrics with good initial "wash-and-wear" properties have been obtained from agents prepared from the N-substituted melamines, several problems remain to be solved before the finish can compete with others on the market.

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DYEING UNSCOURED WOOL

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INTRODUCTION

IN the practice of wool dyeing it is generally accepted procedure to scour the wool, prior to dyeing, to a maximum of 0.50% grease retention.

After dyeing it has been found necessary to add oils or emulsions to the fibers as protective coatings and for lubrication against tangling, matting and tearing in the ensuing processes of carding, combing, spinning, plying and weaving.

The work detailed in this paper indicates that the prior scouring of wool and subsequent replacement of lubricants which later must be removed is not essential.

Dyeing can be carried out on wool which has a sizable grease content. The retained grease does not materially affect the dyeing operation, but acts as a protective agent against matting during the dyeing and against mechanical stress and friction in the subsequent operations up to the finished product. Intermediate removal of additives or contamination at various stages is made unnecessary in most cases.

Such a procedure, dyeing wool with a sizable grease content, is made feasible with a considerable number of dyes, through the use of a preliminary water treatment and a subsequent scouring at temperature and pH conditions which have no effect on the fastness properties of the dyes, but which effectively remove the retained grease.

Thus the conversion of the wool fleece to the finished item is reduced in the number of steps required and each fiber is fortified against operational hazards, both chemical and mechanical during the conversion, or until the wool grease is removed.

The steps of such a procedure are described herein, with detailed fastness comparisons of various classes of dyes applicable to wool dyeing.

DISCUSSION

The initial use of wool by man was for functional purposes, to keep him warm. With expanding civilization, aesthetic properties became relatively more important. This change led to removal of the objectionable portions of the wool fleece, such as the dirt and yolk. Carried to its ultimate, this meant almost complete removal of all extraneous matter, leaving practically only the wool fiber.

Up to the present, this condition of the fiber was compatible with dye application to further enhance the aesthetic value of wool. Also, the application of dyes and the processing of wool fibers to finished cloths impose penalties of degradation of the tensile properties. At those times that wool was a superior fiber functionally and satisfactory aesthetically, efforts to improve it were minimized by lack of necessity and competition. Its position in the economy was relatively stable.

With the advent of synthetic fibers, the number of aesthetic and functional demands satisfied by these fibers and not met by wool has increased. This created a situation in which competition threatened the security of the position held by wool.

Efforts are being expended to enhance the quality of wool. This can be done by either improving the physical properties or retaining its initial natural properties. Attempts to improve the physical properties of wool through breeding, change of environment and feed control of the sheep are a matter of history, ancient and modern.

Attempts to retain the initial physical properties of wool through prevention of degradation during processing are a part of the considerations of all processors of wool or wool fabrics as a matter of self interest, as are the continued attempts to produce more appealing cloths and colors.

RAW WOOL——Fleece wool is a heterogeneous conglomeration of dirt, grease and fiber. Despite action of wind, rain, rubbing against other sheep, the ground or vegetation, the fibers on a fleece will be found remarkably free of entanglement and can be readily separated. Natural protection is provided by the exudation product of the sheep's body glands called yolk. This is mainly a mixture of wool grease and suint that surrounds each fiber. In fine wools, the yolk, and dirt, amount to half or more of the total fleece weight. It is therefore understandable that, since each fiber is covered with a sizable weight of yolk, clean fiber surfaces do not touch and the fibers are held in parallel by the yolk.

CLEAN WOOL——The removal of foreign matter to produce clean wool fiber has been accomplished by two general procedures: first by mechanical combing out or carding out the dirt, sand, burrs, scabs, motes and adhering vegetation and then following with a scouring process which dissolves out the suint and emulsifies out the grease and occluded dirt.

When excessive vegetable matter is still left in the wool after the combing or carding and scouring, a carbonizing operation is given the wool. This is a saturation of the wool with weak sulfuric acid or acid salt solution, which, upon drying, carbonizes the cellulosic matter by dehydration. The carbonized matter is dusted out.

As previously mentioned, complete or nearly complete removal of all extraneous matter leaves the wool fiber in a condition, that, because of the nature of the fiber surface, causes difficulties in processing. The fiber scales tend to interlock. This results in matting, tangling, *shrinking*, fiber rupture in dry mechanical processing and felting in wet operations. To minimize the effects of mechanically caused fiber interlocking, oils or emulsions of oils are used to

lubricate the fibers for spinning into yarn and weaving into cloth.

Contrary to its action en masse, a single wool fiber can be processed through washing, scouring, dyeing, etc, without shrinkage.

PRODUCING CLEAN WOOL BY WET PROCESSING——In general, the wet processing of raw wool to remove suint and grease entails a water treatment followed by an alkaline soap treatment called scouring. Solvents and synthetic detergents are also used. Much of the information regarding past scouring practices has been described by Matthews (*1*).

Much work has been done in investigating new scouring methods, or improving older ones. Soap and soda ash scouring was investigated by Dubeau and Vincent (*2*) and superior quality results reported. The scouring of carpet wools was investigated by Leonard and Winch (*3*).

More recently, neutral wool scouring with synthetic detergents has come into use. This method is reviewed by McNamara Jr (*4*) and by Hansen (*5*).

A solvent process is illustrated by Laxer (*6*) in a study of scourable wool brands.

Scouring procedures are mainly intended to produce wool fiber which is essentially of a grease content below 0.50%. In the past this percentage has indicated the wool to be suitable for bleaching and dyeing. Otherwise dye adhered to or was occluded in the grease and rubbed off or crocked badly, as did the occluded dirt. From a quality standpoint the results were unsatisfactory, unless the wool was properly scoured.

PRESENT WORK——The work reviewed in this paper indicates that complete removal of the wool grease is not essential prior to dyeing, as previously thought. A retention of about 8% wool grease does not interfere with obtaining color value and fastness results obtained by dyeing scoured wool.

To determine what dyes and procedures would permit retention of the wool grease and be operable from the viewpoint of satisfactory fastness results, it was necessary to determine the conditions of washing or dirt removal that could be used to give a controlled retention of wool grease.

Using a fine-quality wool in the fleece as shorn from the sheep, the effects of water treatments and scouring on the grease content of the wool were investigated. The procedure and data follow.

EFFECT OF WATER TEMPERATURE ON FLEECE WOOL——Fleece wool was blended by separating it into small parts and mixing them well. This mixture was then pulled apart as before and further mixed thoroughly. The pulling apart and mixing was repeated a third time to obtain what appeared to be a satisfactory blend of which any portion of about a gram in weight would be representative of the whole.

100-gram portions of the blended fleece wool were then treated in one liter of water at different temperatures as follows:

Enter into one liter of water, stir one minute, remove, squeeze out.

Repeat three times to make a total of four individual soakings for each 100 grams.

Run tests at 100°F, 120°F, 140°F, and 160°F.

Dry and condition at room temperature.

The wool became cleaner and whiter with each higher temperature, and showed the following effect on the weight:

100°F—100 g to 55.00 g
120°F—100 g to 50.75 g
140°F—100 g to 47.00 g
160°F—100 g in 44.75 g

SPRAYED WOOL——2,048 grams of the grease wool (fleece) were sprayed in random sections of between five and 10 grams in weight, on a 40-mesh screen, with tap water at 140°F. The wool was then passed between clothes-wringer rolls to remove excess water and was hot-air dried.

After conditioning at room temperature, the wool weighed 830 grams or 40.53% of its initial weight. This lot was then used in a dyeing study comparison against scoured wool.

STANDARD SCOURED WOOL —— Standard scoured wool was prepared by immersing the grease wool (fleece) in 16 times its weight of water at 130°F, and holding it so for one minute, then draining the liquor.

The immersion was repeated twice (total three times) as well as the draining and the wool was then entered into a scouring bath at 125°F, of 2.0% soda ash solution and 0.50% soap solution (Olate flakes).

The wool was worked gently for 30 minutes, the bath was dropped and the wool copiously rinsed by dropping the liquor and reflooding until the wool was at a practically constant pH.

Samples of the wool were checked for pH and found to be 9.40, 9.30, 9.10, 9.30, and 9.30. After a four-hour immersion in water containing five ml of 28% acetic acid per liter, the pHs changed to 5.80, 5.80, 6.10, 5.70, and 5.60, respectively.

The wool was hot-air dried and used as a standard in dyeing comparisons.

A comparison of the water-steeped wool with wool sprayed on a screen with tap water at 140°F showed that the sprayed wool looked whiter than the wool soaked at 160°F.

Removal of the suint at lower temperature leaves a greater amount of grease and occluded dirt on the fibers. The benefit of the emulsifying action of the suint in close contact with the grease is not fully obtained and the wool is left dirtier.

DIAMMONIUM PHOSPHATE—This chemical provides a range of pH values from alkaline to acidic on dissipation of ammonia at the boil. Its effect on grease wool was studied to correlate with its action as a dyeing assistant with neutral (metallized) dyes. (See Table I).

The average wool residue of the 15 samples was 36.30 grams from 75 grams initial weight or 48%.

On the basis of diammonium phosphate concentration, there is apparently no greater effect from the 5% concentration than from the 1% (weight of fiber basis). The amount of suint, dirt and grease removed are not distinctly different on the average.

SYNTHETIC DETERGENT SCOUR——The use of synthetic detergents as scouring agents was mentioned earlier. Of particular interest are the nonionic compounds. These materials are effective emulsifiers of grease or oil, especially wool grease. They have the the further important attribute in that some are active in small quantities and operable at convenient temperature, and in neutral or nonalkaline conditions.

A study of the nonionic compounds shows that they

TABLE I

Diammonium phosphate treatment

Fleece Wool at 190°F
Starting Weight: five grams—30/1 volume
(Percentages on weight of fiber)

	% DAP	Time (min)	Weight treated wool (grams)	Insoluble residue (grams)	Solubles (grams)
1	1	15	2.425	0.991	1.584
2	2	15	2.462	0.896	1.642
3	3	15	2.420	1.167	1.693
4	4	15	2.350	1.197	1.453
5	5	15	2.332	1.353	1.315
6	1	15	2.337	1.456	1.207
7	2	15	2.530	1.535	0.935
8	3	15	2.527	1.488	0.985
9	4	15	2.480	1.461	1.059
10	5	15	2.610	1.701	0.689
11	1	15	2.057	1.510	1.433
12	2	15	2.314	1.610	1.076
13	3	15	2.600	1.360	1.040
14	4	15	2.464	1.277	1.261
15	5	15	2.304	1.713	0.983

Average weight of wool after DAP

1% DAP—three samples—45.46% of original
2% DAP— " " —48.64% " "
3% DAP— " " —49.12% " "
4% DAP— " " —48.62% " "
5% DAP— " " —48.30% " "

are clear in water dilution up to a definite temperature, dependent on the concentration. Above this specific temperature the solution becomes cloudy and the temperature is referred to as the cloud point. Additions of materials that lower the cloud point permit of operating at lower temperatures.

Using Deceresol NI Conc Wetting Agent (an alkylarylpolyether alcohol nonionic detergent) (7), it was found that its cloud point could be lowered by the addition of sodium *meta*-bisulfite. Based on tests at practical concentrations for scouring, the results were as shown in Table II.

These conditions are equivalent to a 20/1 liquor-to-wool ratio with 2% owf Deceresol NI Conc Wetting Agent.

As a result of the above finding, the following procedure was used as a scouring formulation for comparison versus those mentioned previously:

The sprayed-only wool was immersed in 20 times its weight of water at 135°F, containing 2% Deceresol NI Conc Wetting Agent (owf) and 3% sodium *meta*-bisulfite. The wool was agitated lightly for five minutes. This was followed by a rinse and passed through a wringer before drying.

GREASE CONTENT OF TREATED WOOLS——Analyses of the grease content are given below, of the wool subjected to the treatments described herein. Results are by petroleum ether Soxhlet extraction.

1) Original grease wool (fleece)	16.50%
2) a. Steeped at 130°F, soap-soda ash 125°F	0.48%
b. Steeped at 130°F, soap-soda ash 125°F	0.58%
3) 2½% Diammonium phosphate—30-min boil (average of 10 on sprayed wool)—hand blended lots.	6.30%
4) Steeped at 100°F	13.20%
5) Steeped at 120°F	11.90%
6) Steeped at 140°F	9.10%
7) Steeped at 160°F	6.10%
8) Sprayed at 140°F	7.90%
9) Steeped at 125°F plus soap and soda ash scour 125°F	0.91%
10) Sprayed at 140°F plus soap and soda ash scour 125°F	0.21%
11) Sprayed at 140°F—Deceresol NI Scour 135°F	0.48%
12) Sprayed at 140°F—Deceresol NI—bisulfite 135°F	0.42%

These results of analysis for grease content after the treatments indicate that water temperature in pretreatment for scouring is important. Among other factors:

1) More grease is removed at higher water temperature.
2) Spraying is superior to steeping.

TABLE II

Cloud point—Deceresol NI

Volume 100 ml	*Cloud point*
Deceresol NI—0.100 gram	129°F-130°F
plus	
Sodium *meta*-bisulfite—0.050 g	118°F-119°F
" " —0.150 "	117°F
" " —0.300 "	116°F
" " —0.500 "	115°F
Sulfuric acid —0.100 "	117°F

3) Boiling with diammonium phosphate does not remove more grease than water at 160°F.
4) Scouring with a nonionic detergent such as Deceresol NI is an efficient means for obtaining clean wool.
5) Soap and soda ash scour is effective in grease removal.

DYES AND DYEING——The action of dyeing procedures and in some cases the use of specific dyes have been known to have a harmful effect on the tensile properties of wool. The attempts to modify procedures by shortening operations, using milder chemicals and using new dyes that indicate superior fastness under less rigorous conditions are a continuing consideration with all concerned with the quality of wool products.

According to Perryman (8) in a study of "The Effect on Wool of Boiling in Aqueous Solutions," even the dissociation of ammonium salts with the resultant escape of ammonia at the boil caused a change in the pH with the effect of degradation of the tensile properties of the wool through disruption of the disulfide linkage and loss of sulfur.

Textile World of mid-November 1953 lists the effect on wool of a number of chemicals, temperature, time and of pH. It is shown that distilled water alone, under some conditions, has a degrading action on the tensile strength of wool.

It is apparent that the wool requires some kind of protection against degradation in wet processing. In practice it has been found that higher percentages of strong acid as well as higher pHs from strong alkalis deteriorate wool strength excessively.

CHROME DYES——The introduction of the use of metals (metallic salts) with synthetic dyes was a big step in improving fastness to light and washing of dyed woolen items. The initial use of chromium salts did not, however, shorten the dyeing procedures. In most cases the premordanting or afterchroming steps lengthened the dyeing operations and therefore not only did not reduce degradation of the wool strength but contributed to it.

The metachrome or one-step procedure in which the dyeing and metalization took place simultaneously was limited in the number of dyes applicable and did not, as a result, allow a sufficient number of desirable shades. This limit of desirable shade was also true of dyes applicable by the chrome bottom and afterchromed procedures. So, besides not contributing to the retention of more of the tensile properties of the wool, the use of chrome dyes did not satisfy the aesthetic demands satisfied by the brighter though less fast acid dyes.

TO BE CONCLUDED IN MAY 29 ISSUE

PROCEEDINGS

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1960 Convention———

MODERN CONTINUOUS DYEING PROCESSES*

DR RICHARD KERN
Basle, Switzerland
Sandoz Ltd

First mechanization and automation of textile processing in general is analyzed. Continuous dyeing processes, such as pad-steam, and their limited possibilities as far as the application of various dyestuff groups are concerned, are briefly discussed. It is shown that it is impossible to apply continuously substantive dyes, except in very pale shades, successfully and economically. Experiments prove that in normal dyeing the dyeing time is shortened if the temperature of the dyebath is raised above the boil by applying pressure. Further tests show that the time necessary for fixing dyestuffs by steaming can be shortened by raising the temperature. A pressure steamer was constructed which makes it possible to steam, at a temperature of 248°F, material passing continuously through.

With such equipment it is possible to apply substantive dye continuously without need of long steaming times. Various tests show that it is also possible to apply disperse, acid, and premetallized dyestuffs to various synthetic fibers and blends. Such equipment is currently used in Europe to dye ribbons and tapes.

There is also in existence a prototype of a bulk machine for normal width goods which is at the moment being tested in bulk production.

INTRODUCTION

TODAY it is almost impossible to open a periodical or newspaper without coming across an article or at least a news item on cost control and automation. The two terms, especially the latter, are used in connection with every conceivable field of production from rockets down to household equipment. What is meant by them? They refer to the steady trend toward the mechanization of industrial processes, the aim of which may be to increase productivity while economizing labor or minimizing labor wastage, or to provide better and easier working conditions.

It will be interesting to take a look at the textile industry to see how far cost control and automation have progressed in this sector.

PROGRESS OF COST CONTROL AND AUTOMATION

In spinning and weaving—dry textile processing, if the expression is permitted—mechanization began very early and caused much strife and unrest, but tremendous progress has been made from the first mechanical spinning machines and looms to the new automatic machines, and one is tempted to assume that we have reached a level of achievment which will be hard to surpass. Yet it would be rash to look upon the present state of progress as final, for the textile machinery industry, not least that of Switzerland, which has a fine record of achievement in this field, is constantly introducing new refinements. Thanks to this development, productivity has increased a great deal in relation to the expenditures of labor, and this has undoubtedly led to cheaper textiles which in turn benefit the consumer, that is to say, all of us.

Wet textile operations can be divided into three groups, those carried out before dyeing, such as desizing, scouring and bleaching; dyeing itself; and finishing treatments.

PRELIMINARY OPERATIONS——In the past few years, various semi- and fully continuous processes have been developed for the preliminary operations, and the textile machinery industry offers a great variety of machines and equipment for this purpose. Naturally they can only be run economically when the yardages are sufficient to keep the plant in continuous use. It must be remembered that many of them operate at running speeds of 50 to 100 yards per minute, in some cases more, and it is easy to work out the output of such machines over a 24-hour period. While these machines were conceived primarily for piece goods, there are today many types which can also be used for loose stock and yarns. Provided that sufficient space and money is available, the various units needed for the different operations can be assembled in series so that the goods are conveyed from one operation to the next without handling. This saves a great deal of time and labor and eliminates the often arduous task of lifting and transporting heavy, wet goods. All the operator has to do is to see that there is an adequate and uninterrupted supply of chemicals and that the goods pass through the equipment under the optimum conditions. Even for these duties there are automatic control instruments, so that in principle it is possible to automatize textile preparation almost completely. All that the worker would have to do would be to make the necessary adjustments when an unexpected situation arose which the machine could not deal with itself. The labor freed by such installations could then be used for other, more productive purposes.

FINISHING——Some finishing processes can be carried out continuously, eg, resin treatments. These operations too can be fully automated and controlled, leaving the worker with supervisory duties only.

DYEING———How is it with dyeing, the main subject of this lecture? When we review the various dyeing machines now in use, we can divide them into two main groups, those in which the goods are stationary and the dyeliquor is circulated, ie, the circulatory machines used mainly for loose stock and yarns and in some more recent models for piece goods, and those in which the dyeliquor is stationary and the goods in motion, the type used chiefly for piece dyeing. All these machines have one thing in common: they are operated discontinuously. When one is dyeing to meet a big order, the process must be repeated a great number of times to obtain the total yardage. It is obvious that with so many repetitions faults can easily arise and that the whole operation makes heavy demands on time and labor. True, there have been great advances in the design of these machines, which facilitate their operation considerably and in many instances permit a certain

*Presented October 7, 1961 at the Sheraton Hotel, Philadelphia, Pa.

saving of labor, but this limited degree of automation has not changed the basic discontinuous character of the dyeing process.

There is, however, one exception—the dyeing of cotton and rayon piece goods with selected classes of dyes. Before the war, the problem of cost control was being thoroughly studied and it was found that the behavior of certain groups of dyes could be utilized as a basis on which to develop continuous techniques. I am thinking here of the naphthols, the vat dyes and the esterified vat dyes.

With the naphthols, the dye is formed on the fiber and, as the coupling reaction is very rapid, it can be carried out continuously. The goods are padded with the naphthol, dried, and impregnated with the diazotized base or dye salt on a pad and/or an open-width washer, upon which coupling takes place. This is followed by continuous rinsing and soaping. With the esterified vat dyes as well, a simple continuous process is possible: the dissolved dye together with sodium nitrite is applied to the goods on a pad and then, with or without intermediate drying, the dyeing is developed by a passage through a sulfuric acid bath with subsequent rinsing and soaping in an open-width washer. Finally, with vat dyes, two continuous processes are practicable, using an open-width washer in the older method and a steamer in the newer. In both, the goods are usually impregnated with the unreduced, finely divided dye on a pad, dried, and passed through a roller box or Williams unit in the older method or through a pad containing caustic soda and hydrosulfite in the newer one. In the first process this solution is hot so that reduction takes place immediately, while in the second it is cold and reduction takes place in the steamer. Besides these two processes there are several variations, eg, the Standfast Molten Metal and the hot-oil processes.

All the dyeing processes with these dye classes have one feature in common: a chemical reaction is the decisive phenomenon. This circumstance explains why continuous dyeing is possible since in each case the reaction is relatively rapid and, where this is not so, it can be greatly accelerated by an increase of temperature, eg, with vat dyes.

How do matters stand with those groups of dyes with which no chemical reaction takes place during dyeing? I would like to examine this question with the substantive cotton dyes as an example. The times which are necessary to fix a padded substantive dye on the fiber are much longer than, for example, those for vat dyes. There are two suitable fixation methods—salt and steam fixation. In salt fixation the dye-impregnated goods are treated with a solution of common or Glauber's salt at a temperature near the boil, the salt addition being governed by the dyes used. What mainly interests us at present is the time factor. Trials have shown that, as a rule, 20 minutes are necessary to obtain complete fixation and the full yield; any substantial reduction in time results in considerably poorer fastness and depth. Nowadays salt fixation is usually carried out on a jig or winch.

If an attempt were made to develop a continuous procedure from this method, the open-width washer could be utilized. Let us assume that we are working at a running speed of 60 yards per minute and that each roller vat inclusive of the squeeze rollers can take 20 yards of cloth. For every one minute of treatment, we should thus need three vats plus squeeze rollers, and for 20 minutes 60 compartments. In addition there would have to be several extra compartments for rinsing and possible after-treatments. It is easy to imagine how long such a range would be, and that hardly any dyeworks would have the space to install such a monster. What is more, the enormous consumption of water and salt would make the plant thoroughly uneconomic. We can see from these brief considerations alone that salt fixation, at least as practiced at present, is out of the question for continuous dyeing.

The problem takes a different form in steaming. At normal pressure, ie, at temperatures of 102-104°C, tests have shown that most substantive dyes require at least three minutes' steaming, or preferably five minutes, for complete fixation. I would like to mention that there are exceptions to this rule, some dyes requiring less than three minutes, but they do not make up a complete range.

If we again calculate from a running speed of 60 yards per minute, we arrive at a steaming time of three to five minutes in a steamer which can accommodate 180-300 yards of cloth at any one time. It would thus have to be very much bigger than the normal steamer of a pad-steam range, in which the usual dwell times are 30-40 seconds, so that the steamer does not have to hold more than 50-80 yards even at high running speeds. Although it would be possible to build a steamer of this size and install it in many plants, in actual operation it would probably be an unfavorable investment as far as heating and steam consumption are concerned. The machinery manufacturers have built steamers which can be used for fixing substantive dyes, but probably they are not so big as the one we have envisaged, and if they were used, the running speeds would have to be reduced.

The application of substantive and other classes of dyes by the high-temperature process has occupied the attention of dye users, dye makers and machinery manufacturers, all of whom are working intensively on the problem.

From conventional dyeing we know that dyeing times can be substantially reduced by raising the temperature to above 100°C, ie, the well-known high-temperature-dyeing technique.

To illustrate this, I will briefly describe some dyeing tests we have made in the Franke Pressure Dyeing Machine. Viscose hanks were dyed with 3% Lumicrease Grey 3LR Pat 180% at a liquor ratio of 1:40 with a 15% addition of Glauber's salt, once without pressure at the boil in 15 and 60 minutes respectively and again under pressure at 120°C for the same times. Cross-sections of the dyed yarn are shown in Figure 1. At 100°C and 15 minutes a small amount of dye is attached to the surface; after one hour at this temperature it has penetrated to some extent but remains concentrated in the outer layer of the fiber. The dyeing made at 120°C shows that the dye penetrates to a considerable depth in 15 minutes and it can be said that the dyeing results are about as good as those after one hour at 100°C. After one hour at 120°C the dye has penetrated to the core of the fiber, dyeing the entire cross section. From this we can see that dyeing times can be considerably reduced by dyeing under pressure.

The next step was obvious—to increase the steaming temperature, for the construction of a pressure steamer for continuous operation is not a simple matter. But a few trials were enough to show that a temperature increase alone, which means that the steam is no longer saturated, does not produce the desired results. The dye is not fixed and, even with vats, saturated steam is essential for satisfactory results.

The textile machinery industry has been working on this problem for a long time and the firm of Konrad

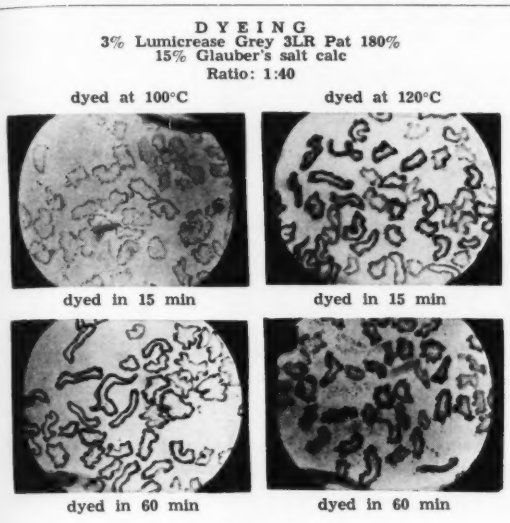

Figure 1

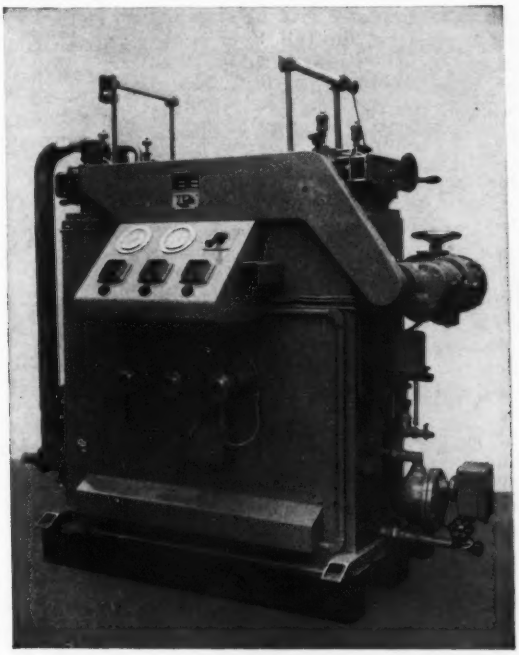

Figure 3
Peter steamer, laboratory-type

Peter AG of Liestal, Switzerland, in collaboration with Sandoz Ltd, Basle, has at last succeeded in building a steamer which meets these requirements. First, the constructional and operating factors involved were examined with a small-scale model suitable for laboratory dyeings and narrow fabrics. It was not difficult to design a steamer to withstand a pressure of one atmosphere, but the continuous passage of the goods at this pressure raised complicated problems of construction. A sealing device at the entry and exit points had to be found which would permit passage of the material but not of steam or water. This was necessary both in order to maintain a constant pressure and to prevent water spots on the impregnated goods. Peter AG solved the problem with a patented device, the operating principle of which is similar to that of their Econom two-bowl pad. It is a horizontal two-bowl pad on which the dyeliquor is contained in the nip between the rollers, and has plates fitted at both ends of the rollers to prevent the liquor running off. With this pad the steamer is sealed in such a way that the goods can enter but no steam can escape. In the steamer itself there are tension adjusters and guide rollers, some of which are power-driven so the goods travel through under very slight tension. Of course the ideal would be to use the entry rollers as a pad, but it was soon found that this was not practicable owing to their temperature. A separate dyeing pad is therefore installed before the steamer.

On the basis of the experience gained with the laboratory type, several of which are already in industrial use for dyeing narrow-width goods, Peter AG has built a normal-sized steamer which is now being tried out in practice. Without going into the various mechanical problems and their solution, I would like to show here some photographs and diagrams illustrating these steamers (Figures 2, 3 and 4). Of course the colorist will be interested above all in knowing if really satisfactory dyeing results can be obtained with the new steamer.

We have tested our theory by padding a narrow fabric of irregular-dyeing viscose with a 70 g/l CI Direct Red 80 solution and steaming for different periods of time at 104°C and 120°C. After steaming, the dyeings were rinsed in cold running water. We can see that the dyeing steamed for 30 seconds at 120°C is considerably heavier in shade than the one steamed at 104°C. The same difference is evident with the pairs of dyeings steamed for two and five min-

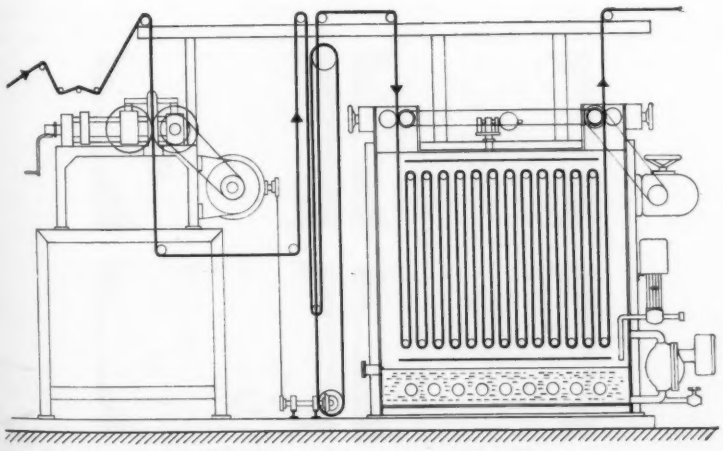

Figure 2
Scheme of the Peter steamer, laboratory-type

utes. This indicates that, by steaming under pressure, the full yield is obtained much more quickly than otherwise. In other words, a shorter steaming time is sufficient. The dyeings also suggest that barré viscose is covered rather better on pressure steaming, although the barré effect is not entirely absent from our material. Cross-sections of these dyeings have been prepared to examine the penetration. Figure 5 is of the 30-second dyeings and the ones produced at 104°C with five minutes' and at 120°C with two minutes' steaming. They show very clearly that, after 30 seconds and 104°C, the dye remains on the fiber surface, while at 120°C it has penetrated far into the fiber; in the other two sections the fibers are completely penetrated. After five minutes at 120°C the dyeing is simply deeper, but this effect is not revealed by photography.

We can see, therefore, that steaming under pressure does in fact save time, and that two minutes' steaming is sufficient to obtain complete penetration of viscose.

After the tests described above, we proceeded to examine a series of direct dyes, first to ascertain their suitability for dyeing under pressure and at the same time to see if higher yields could be obtained by certain additions to the padding liquor.

It was found that additions of 100 g/l urea and one to five grams per liter sodium pyrophosphate gave the best results. The dyeings are generally somewhat brighter than usual with these additions, and the yield seems to be rather better as well. In this connection it may be mentioned that dyeings produced by the pad-steam process are usually a little duller than ordinary dyeings. We attribute the effect of these additions on the one hand to an improvement of dye solubility, especially marked at concentrations near the solubility limit, and to the fact that under certain circumstances they prevent association of the dye molecules; on the other hand urea certainly acts as a moisture-retaining agent in steaming, which is also desirable. In this connection I would remind you of my earlier remarks on steaming with unsaturated steam, where the results are unsatisfactory precisely because of the insufficient moisture content.

I would like to illustrate the results obtainable by dyeing under pressure with an example. We padded 20 g/l Pyrazol Fast Rubine BLN Pat on cotton, fixing one piece in a normal bath of distilled water and

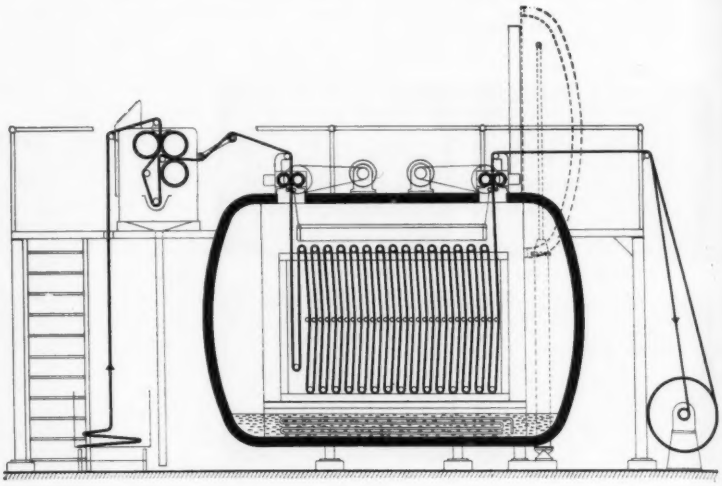

Figure 4
Scheme of the steamer as used in actual practice

salt and the other pieces by steaming at 104°C, 120°C and 130°C for 30 seconds, two, four and six minutes (Figure 6). After fixation, all the dyeings were rinsed in the same amount of distilled water and in this rinsing water a fresh piece of material was treated. An exhaust was taken from the bath used for the exhaustion dyeing. On the pieces steamed at 104°C for 30 seconds, very little dye is fixed, about as much as in the exhaustion dyeing, while on those steamed under pressure, considerably more dye has been fixed even after this short time. A difference can be observed between the dyeings steamed at 120°C and 130°C, but it is not so great by a long way. Even with the longer steaming times it can be clearly seen from the exhausts that pressure steaming has brought about a higher yield.

Having established the fact that pressure steaming gives better results, it will be interesting to know how much greater the color yield is.

For this purpose we have compared four dyeing methods: the pad-jig, Pad-Roll, and the pad-steam processes—the latter at 104°C and 120°C.

In the pad-jig process, the dyeing was fixed in 20 minutes near the boil with 15-20 g/l Glauber's salt calc and in the Pad-Roll process by dyeing-in for four hours at a dry temperature of 90°C. In the two pad-steam procedures the goods were steamed for two minutes. Longer steaming times were avoided because they would have been inappropriate for practical reasons. After fixation, the cotton and

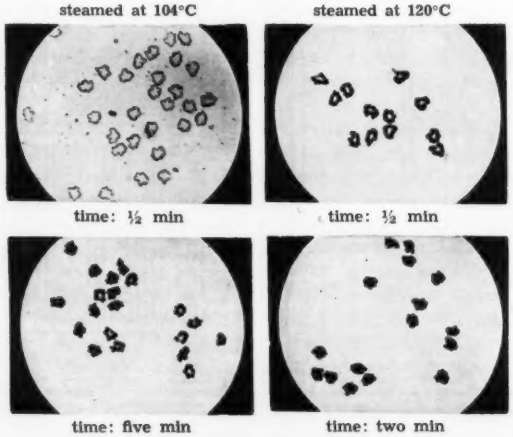

Figure 5

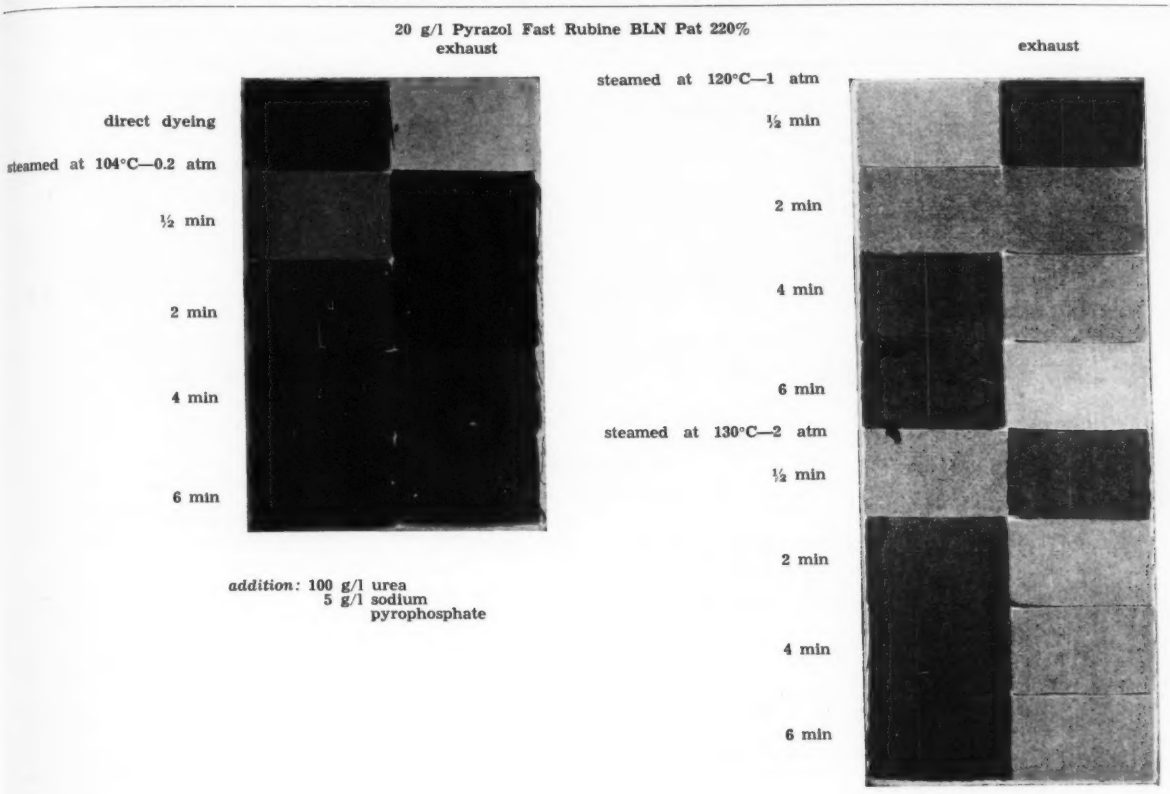

Figure 6

rayon pieces were rinsed in equal amounts of water at 40°C and the unfixed dye determined by colorimetric measurement. From the initial amount of dye and the measured value of unfixed dye the amount of fixed dye was calculated. For these tests we used three dyes: Lumicrease Yellow 3LG Pat 160%, CI Direct Blue 77 370% and Lumicrease Grey 3LR Pat 180%. In normal dyeing, Lumicrease Yellow 3LG Pat, without salt, dyes very poorly and requires high temperature and a substantial salt addition for exhaustion, whereas Lumicrease Grey 3LR Pat has very high affinity, dyes well even at low temperatures and needs little salt. The blue is intermediate between these extremes. The tests were carried out at various dye concentrations giving very light to heavy shades close to the solubility limit of the dye. The yield was determined as a percentage of the initially applied dye and the values plotted on a graph.

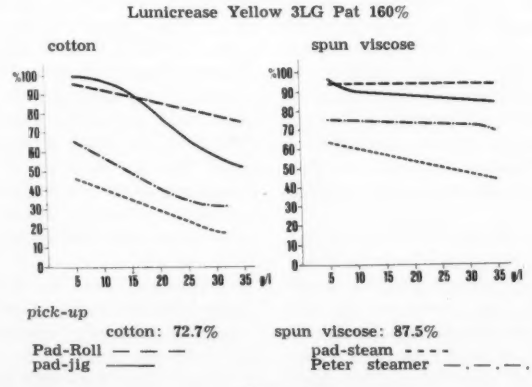

Figure 7

With Lumicrease Yellow 3LG Pat the yield on cotton falls rather rapidly with increasing dye concentration, while on rayon it remains relatively constant (Figure 7). Both in the pad-jig and Pad-Roll processes the yield is appreciably higher than in the steam procedures, the Pad-Roll system giving better results especially at heavy concentrations. This agrees well with the experience we have gained in practical work. The curve shows distinctly that pressure steaming results in a yield about 10-20% higher than normal steaming. Similarly, the curves for CI Direct Blue 77 dyed by the pad-jig and Pad-Roll processes lie above those of the steam processes. The curves of the steamed rayon dyeings, however, come close to those of the others. In my opinion the first section of the two steam curves is rather questionable, since in light shades almost all the dye is fixed, which means that the rinsing water is very nearly clear and the accuracy of colorimetric measurement correspondingly less. Here again we have approximately the same degree of improvement in yield through pressure steaming (Figure 8).

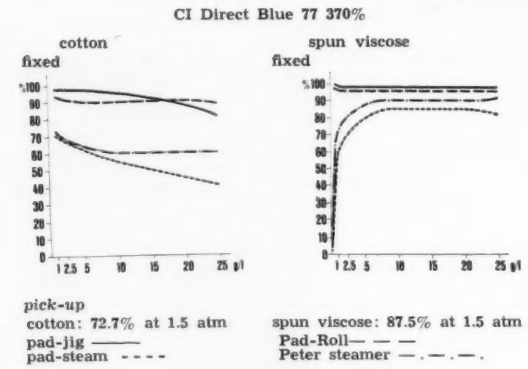

Figure 8

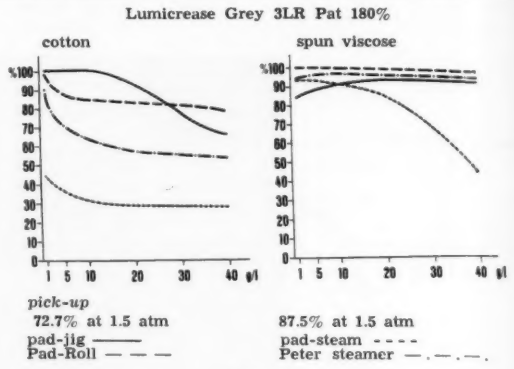

Figure 9

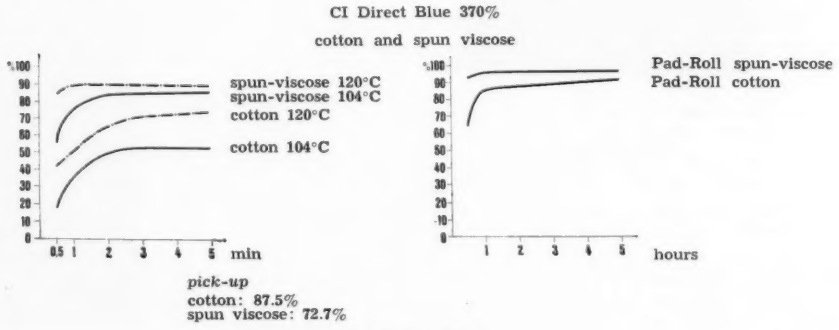

Figure 10

Lumicrease Grey 3LR Pat (Figure 9) gives the same picture as regards comparison of steaming with the other methods, but here pressure steaming leads to a substantially better yield than normal steaming. On rayon especially the yield with normal steaming drops sharply at increasing dye concentration, while on pressure steaming the results are slightly better than in the pad-jig process, and, what is important, they remain constant.

A further trial was carried out by this method in order to determine the effect of time on fixation (Figure 10). Cotton and rayon dyeings of 10 g/l CI Direct Blue 77 370% were steamed at 104°C and 120°C for 30 seconds, one, two, three, four and five minutes, and the Pad-Roll dyeings dyed-in for one, two, three, four and five hours at a dry-bulb temperature of 90°C. With the steamed dyeings, particularly those on rayon, we can see that the yields are relatively good after short steaming times at 120°C, while at 104°C the yield increases at a slower rate. On cotton, steaming under pressure gives a much better yield than normal steaming. In the Pad-Roll process it can also be observed that fixation on rayon takes place considerably more rapidly. The Pad-Roll system, in fact, still gives the better yields even though the values for the rayon dyeings lie very close to each other.

On studying these curves, one may be inclined to say that the results of steaming at 120°C are on the whole disappointing, the yields not being comparable to those of the pad-jig and Pad-Roll processes, and that the steaming process is not a worthwhile proposition. But when it is remembered that the steaming process is continuous while the others are not and that fixation is completed in two minutes compared with several hours, it should be more profitable for big batches in spite of the higher dye consumption, because the cost of power and labor will probably be less. Moreover, the greater consumption of dye can be brought down to a minimum by choosing the most suitable brands.

In this age of synthetic fibers and blends of synthetic and natural fibers, a dyeing range should have multiple uses and not be restricted to one group of fibers. From this standpoint great interest is attached to the potential uses of the Peter high-temperature steamer in synthetic-fiber dyeing. Normal dyeing practice has shown that many synthetic fibers can be dyed more successfully under pressure than at subboiling temperatures. Since this precondition is present in the steamer, the only remaining question was whether the time available for fixation would be long enough for the classes of dyes used for synthetic fibers.

We next examined the disperse dyes by repeating the above-described tests on acetate, polyamide and polyester fibers. The pad-jig process was dropped and only the Pad-Roll process used for comparison. The dye chosen was Artisil Violet RFL ultra-dispersed Pat/ Foron Blue 3RFL ultra-dispersed Pat (Figure 11). The curves demonstrate that both on acetate and nylon the yields in all three processes are very good, but in each of them pressure steaming gives the highest yields, especially in heavy shades. On polyester fibers the yields obtained at high concentrations on steaming at 104°C fall sharply, but the loss is not so great after pressure steaming and remains practically constant on the other fibers tested.

What effect does this have on dyeing results? Since the disperse dye-

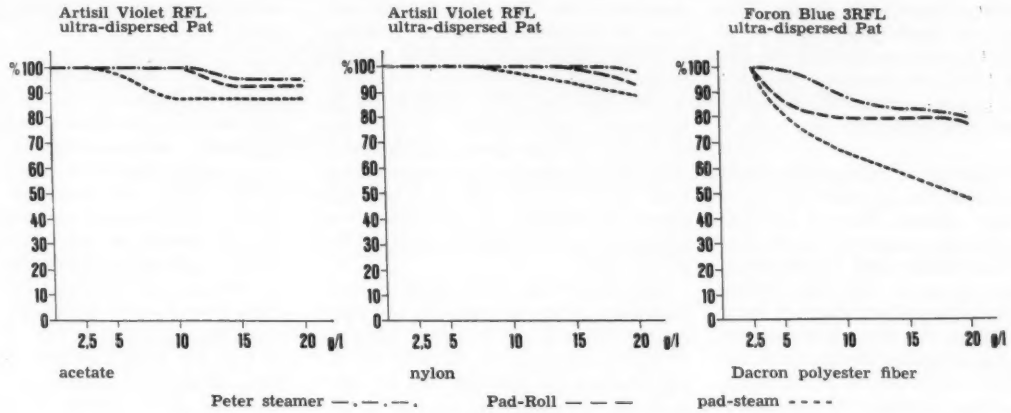

Figure 11

ings on nylon and acetate only show slight differences of depth which cannot be brought out by projection, I shall not exhibit them here. Instead I will show some of the results obtained on triacetate, polyester and acrylic fibers. The ordinary triacetate dyeing was compared with dyeings steamed for two minutes at 104°C and 120°C. It can be seen at a glance that steaming at normal pressure has not resulted in the yield obtained by ordinary dyeing, but with pressure steaming it is easily attained and in some cases surpassed.

The following test shows two dyeings on polyester fiber. The normal dyeings were dyed with a carrier because, without this addition, no true comparison can be made. Again one can see immediately that an acceptable yield can only be obtained by pressure steaming. There are nevertheless marked differences of shade and depth between the normal dyeing and those steamed with pressure. The differences of depth are undoubtedly due in part to better penetration, and we are inclined to believe that the shade differences may be caused by a different distribution of the dye in the fiber.

To gain a better insight into these questions, we tested the washfastness at 60°C of the dyeings with polyester fiber and acetate fabrics. Here too it could be seen that the normally steamed dyeing has much poorer fastness, but neither does the pressure-steamed dyeing attain the fastness of the normal dyeing. In dry and wet crocking fastness, as well, the same relationship is found. On the basis of these results it can be said that, while pressure steaming gives better results, it does not equal the standard of the normal dyeing in these respects. The dyeing of polyester fibers with the Peter high-temperature steamer must therefore be given closer attention. It is quite possible that additions to the padding liquor will provide an answer to this problem as well.

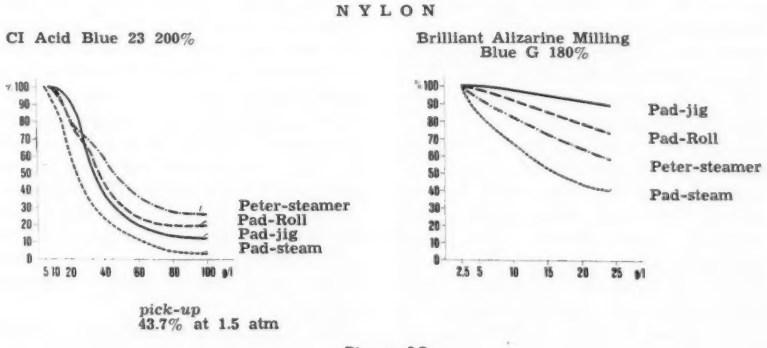

Figure 12

Another test illustrated the results on acrylic fiber. Here again we have seen that pressure steaming has produced substantially better results than normal steaming—the depth is at least equal to, or even greater than a normal dyeing. Wash tests on this material have shown that the pressure-steamed dyeings are as fast as the normal dyeing in shades of all but the heaviest depths, while the dyeings steamed at normal pressure are poorer.

For nylon there is of course another class, the acid dyes, which are often preferred because they have better wetfastness than the disperse dyes, though at the same time they present the problem of barré dyeing. We examined the yields obtainable on nylon by the same method as before, using two dyes, one with a low and the other with a high saturation point. The curves (Figure 12) show the difference between them. At concentrations higher than 20 g/l, all the curves of CI Acid Blue 23 200% drop very rapidly, while with Brilliant Alizarine Milling Blue G 180% they fall off at a much slower rate. In both cases steaming under pressure gives appreciably better results than normal steaming. With the dye having a low saturation point, dyeing in the Peter steamer at high concentrations gives the best results, while at low concentrations and with Milling Blue G the Pad-Roll and pad-jig methods give the best yields. The dyes were padded with ammonium sulfate. In the pad-jig process the ammonium sulfate was added in the jig.

In the next test the normal dyeings were compared with steamed dyeings. The latter were steamed immediately after padding, while the others were dried after padding. The normal dyeing is essentially a pad-jig dyeing. Here also it was seen that steaming at 104°C does not give the depth obtained by normal dyeing, but this depth is attained by steaming at 120°C. The dyeings which were dried after padding were in both cases lighter than the undried dyeings, but here again those steamed under

pressure were heavier in shade. This difference of depth may be due to insufficient moisture content in the goods. In the short steaming time the material cannot absorb sufficient water and consequently less dye is fixed.

In the dyeing of polyamide fibers with acid dyes the problem of barré dyeing also arises. This is a long-standing dyeing problem which has been given a great deal of attention. In normal dyeing it has been found possible to obtain level dyeings by a suitable choice of dyes and the use of special dyeing assistants, such as Lyogen P.

What is the position in padding?

A later test involved the dyeing of a narrow nylon fabric specially woven for test purposes and exhibiting marked barriness. We again compared a normal dyeing alongside others steamed at 104°C and 120°C with and without intermediate drying. In the normal dyeing it could be clearly seen that the barré effect remained very pronounced, but in the steamed ones this was much less so, and of the latter those dried before steaming were better than those steamed in the wet state. The reason for this is probably that in a dried dyeing the dye cannot migrate so easily owing to lack of water as vehicle. Whether a dye dyes barré or not depends in great part on its rates of migration and fixation: one with a rapid rate of fixation but a slow rate of migration will be sure to give better coverage than another with these properties in the reverse order.

As I mentioned earlier, there is a widespread demand today for higher colorfastness on nylon, a demand which has already led to the increased use of acid at the expense of disperse dyes. The very highest fastness on polyamide fibers, however, is obtained with 1:2 metal complex dyes, though unfortunately this is offset by the fact that they show up barriness rather badly. Preliminary treatment of the goods, or the additions of the agents which serve to prevent barré dyeing with ordinary acid dyes, do nothing to promote level dyeing of metal complex dyes applied at the boil.

How does this class behave when steamed under pressure? Provided fixation takes place more rapidly than the dye can migrate, it can be expected that the dyeings will be fairly level, since the dye is evenly distributed on the surface of the goods by padding. We have examined an entire range of 1:2 metal complex dyes and, save for a few exceptions, we can say that very good results are gained by pressure steaming. In those cases where an intermediate drying operation was introduced the coverage of barriness was even better than otherwise, but this is accompanied by a substantial reduction in the yield. It seems, therefore, that the metal complex dyes can be used with success for dyeing nylon by the Peter high-temperature steaming process.

The dyeing of blended fabrics is one of today's big dyeing topics and we did not neglect its study in our trials. It is possible to dye blends of cellulosic and man-made (including acetate and triacetate) fibers by one-bath processes. An important factor is that both types of dye used should reserve the fiber they are not intended to dye, or should be easy to clear if they do stain it; this in turn depends to a very great extent on the construction of the fabric and must be examined in each individual case.

SUMMARY

Our trials have shown that it is possible to dye cellulose and synthetic fibers continuously by steaming at increased pressure with saturated steam. Since the required steaming times are comparatively short, a continuous procedure can be worked out without difficulty. However, it must be taken into account that certain dyes give poorer yields on pressure steaming, this being due at least in part to the better penetration of the fiber. In spite of this, I am convinced that this disadvantage is more than outweighed by the higher level of productivity and the saving in power and labor. A continuous dyeing range of this kind should be particularly suitable for plants which handle big yardages and concentrate on a few shades. Where and when such a dyeing range can be employed for successful commercial production will depend largely on local conditions and will have to be studied carefully in each case.

CONCLUSION

In conclusion I want to mention that all the trials I have described were carried out on a laboratory scale. We have been able to run some practical trials which have corroborated our findings, so that the results should be generally valid.

I hope my remarks, the trials and results have been of interest and will help to stimulate the further development of new or improved dyeing processes. Advances of this kind finally benefit everybody, for they make it possible to offer the consumer better textiles at the same or cheaper prices.

Elected Members

April 20, 1961

No designation after names indicates Senior
(A) indicates Associate
(J) indicates Junior
(S) indicates Student
* indicates transfer from another class of membership

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Western New England Section

*Bruce R Richmond**

CENTRAL ATLANTIC REGION

Delaware Valley Section

Robert J McLaughlin
William R Taffe

Metropolitan Section

Leonard Fox
Robert U Frondorf
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Philip B Manasse (A)

STUDENT CHAPTERS

Philadelphia College of Textiles and Science

Joseph Fox (S)
Raul J Gil (S)

Lowell Technological Institute

Abdelrahman E Fahmi (S)

AT LARGE

*Marcel Menard**

1960 Convention———

NEW COLOR-MEASURING INSTRUMENTS FOR USE BY THE TEXTILE INDUSTRY*

FRANK J RIZZO and ALVIN O RAMSLEY

Quartermaster Research & Engineering Command, U S Army

Natick, Mass

The Quartermaster Corps and the textile industry have long wanted and needed color-measuring instruments for their individual and mutual purposes. The Quartermaster Corps needs such devices to more adequately control the quality of the materials that clothe and shield the soldier and his equipment to the specific levels essential for the stringent end-use requirements; the textile industry requires instrumentation to stabilize and control each step of the manufacturing process, to reduce or eliminate human error, to establish quality-control levels along objective lines, and to reduce cost. Both groups require instrumentation so that understandings are facilitated and disagreements are eliminated.

The available instrumentation, some quite sophisticated, has not, however, been sufficiently adequate to the task both groups wish it to perform. Many instruments have been developed and marketed, some with rather ingenious features and many have found specific applications in the industry with consequent benefit to the control of quality. Universal acceptance of measuring instruments for routine shade control in the many possible areas of textile operations has not been possible for a number of reasons, a substantial percentage of which are instrument related but some of which are related to inadequacy of the theories upon which the design and use of equipment have been based.

The study reported analyzes the factors involved and shows how corrective steps in design and in concepts of use have been applied to newly developed instrumentation under Quartermaster sponsorship, which, it is believed, goes a long way towards achieving the desired goal of general applicability to textile problems.

A Tristimulus Colorimeter and a Rapid Scanning Spectrophotometer, capable of direct readings of color and color differences are described and their performances defined in comparison with standard visual assessment. General specifications of design characteristics are given and are believed to be the basis for the accomplishment of improved instrumentation meeting all of the essential requirements. Problems possibly solvable in the textile industry by the developed instruments are defined; also the possible uses of this equipment in the inspection as well as development of military textiles are recorded.

INTRODUCTION

LORD Kelvin stated in effect that a science is not an exact science until it can be subjected to measurement and mathematical treatment. In this sense, the oft-levelled accusation that textile science is unworthy of the name might be taken, even if reluctantly, as being generally true. However, it is equally valid for those engaged in its pursuit to feel justifiably proud of the progress that has been made since the dawn of the synthetic dyestuff industry.

If Lord Kelvin's statement is true, it may be considered to be most applicable in the field of color where, in its application as in its assessment, much is still empirical. The situation can be blamed upon the complexity of the subject itself, being an integration of several disciplines: primarily chemistry, psychology, and physics (*1*). It can also be blamed upon an age-old conservative attitude towards change that unfortunately still plagues the industry in many ways and also upon an insufficient scrutiny for textile purposes of the theoretical foundations upon which color science, as it exists today, is based. This is not for lack of an abundant literature or for inattention on the part of brilliant minds to the problems involved. Yet, thirty years after a superb international committee established a sound basis of color (*2*), color-measurement techniques are only very sporadically practiced in the industry and are, in reality, insufficient to the tasks that face both the Quartermaster Corps and the industry.

Despite an enviable record of good relations with the industry that serves it, the Quartermaster Corps, as the world's largest buyer of textiles and textile-based materials, has particular need for color measurement. This need has been apparent for some time. In the past, it has had its strongest basis in war time, when on-the-spot decisions are advantageous, but today it has attained its urgent aspects out of:

1) the technological revolution in dyestuffs, finishes and fibers that the Armed Forces are called upon or feel constrained to consider in the basic plan of development of military clothing and gear;

2) aesthetic and morale problems;

3) economics; and

4) the increasingly urgent desire of industry for a basis upon which to predetermine acceptability of its products before submitting them.

The day of the field uniform serving for all occasions is long past and the existence of an Army made up of career and enlisted personnel demands a uniform system with appearance factors that contribute to higher esprit de corps and morale and provide the soldier, at social as well as on business occasions, comfort and decorum, equal to his civilian counterparts.

While the dress and service uniforms demand the utmost in appearance, the field uniform must contribute to the protection, comfort and effectiveness of the soldier.

The day is fast approaching when important surface parameters of military textiles can no longer be maintained quality-wise solely by subjective methods. It is important today to measure these with the accuracy and precision required in end use and certainly within demonstrated levels of reproducibility.

Today, industry too has a substantial problem that emanates from the revolutionary developments in fibers, dyes and finishes. This is especially so, because of the popularity of combinations of different materials in the same ensemble and the general predilection to harmonize effects between elements of an ensemble either for apparel or decorative purposes. While textile styling generally permits a broader acceptable range of tolerances for civilian use than is possible for military purposes, the tendency today in the industry is for closer limits than ever before and in certain areas, such as automotive fabrics, control factors come very

*Presented by Frank J Rizzo on October 8, 1960 at the Hotel Sheraton, Philadelphia, Pa.

close to those required for military textiles.

Furthermore, a highly competitive system disposes textile practice to tighter quality control levels than ever before. This control is not possible unless each step of the manufacturing process is stabilized and continuously monitored; human factors are eliminated or reduced, and measurable and relatable parameters between manufacturing elements are established and their useful limits defined.

PRESENT STATUS OF COLOR-MEASURING INSTRUMENTS

AVAILABLE INSTRUMENTS—— What then is the situation on the color-measuring devices available to do the job? In fact, it is really quite good, considering that a real attack on the problem did not become possible until electronics had come of age. The subsequent effort has been quite substantial and many fine instruments have been produced and marketed. These instruments have been essentially of two types: the spectrum-scanning instruments and those combining light source, filter and photocell detector, generally referred to as "colorimeters." Some have rather ingenious features; some are quite sophisticated. Some collect all the energy diffusely reflected from a sample surface; some use standard photometric conditions of 0°-45° or 45°-0°; some use smaller angular relations between illuminator, sample and detector.

The spectrum-scanning instruments measure the reflectance of a sample wavelength by wavelength relative to a white reference surface and the response is integrated manually, mechanically or electronically with respect to the tristimulus functions of the human eye and whatever light source is being considered. In the colorimeter type, the light source, filters and photodetector have been used in any one of a variety of angular relationships, with the 45°-0° condition being the most popular. In certain instruments, the illuminant is broken into wave bands by means of band-pass filters, thus producing what is generally known as an "abridged" spectrophotometer. By the introduction of a reference circuit upon which can be impressed either manually or by measurement the values of a specific standard, these instruments have been transformed into what are known as "color difference meters", a form which Hunter (*3*) has shown overcomes many of the errors inherent in colorimeters. The color-temperature response of colorimeters and color difference meters is an integration of the color temperature of the light source modified by the spectral response characteristics of the filters and of the photosensitive surface of the detector. Generally, most instruments have been designed to achieve an effective correlated color-temperature equivalent to Source "C"; a condition somewhat different from that used in standard visual practice.

LIMITATIONS OF THESE INSTRUMENTS —— These instruments in one way or another have found application in research, in development, and in certain phases of production, but the number of applications have been very small in relation to the job that exists. Demonstrated limitations of one type or another have precluded general acceptance and use.

The most obvious limitation has been their inability to give a ranking of materials consistent with visual discrimination on a day-to-day basis. In an era when photodetectors are capable of a degree of sensitivity equal to or surpassing that of the human eye, it is indeed disturbing to find the composite optical-electronic system beset with problems in reproducibility, sensitivity, precision, accuracy, temperature and humidity effects and, in particular, illuminant-detector-function-generator aberrations.

The reasons for this situation are many and complex. Cost considerations have contributed; there has been a lack of appreciation among designers for the need to achieve relatedness between instrumental illuminating and viewing conditions and those used in textile visual practice. (There has been, in fact, a special preoccupation with eliminating any specular component, even though this is included in visual practice. It is appropriate to mention that before the use of standard color matching lamps, when the industry relied on north sky daylight, which was a diffuse illuminant, the best approach to a correlation was found to exist by the use of a sphere. It is also appropriate to mention that the color matching lamps have produced a more directional, less diffuse type of illuminant in visual color matching.) There has been a failure to appreciate the theoretical foundations of color science and the essentiality of assessing the extent to which the theory requires modification to correct for the specific surface phenomena presented by the materials to be measured.

In the field of textiles we deal not in smooth uniform surfaces, but rather in surfaces of varying degrees of roughness, from high specularity (gloss) to high diffusivity, of marked directional effects, of varying degrees of transluscency and transparency, containing a complex of shadow and highlight, of selective absorptions and reflectances, of viewing angle-related dichroic effects and of many other properties. The dyes and finishes applied for functional purposes add additional problems due to changes in surface roughness, to finish-fiber interface diffraction and refraction and to such time, intensity or temperature-related effects as metameric, phototropic and thermotropic shifts. To one degree or another, these tend to modify the surface properties and thus constitute an added challenge to the design engineer.

THE CHARACTERISTICS OF A "SATISFACTORY" INSTRUMENT FOR TEXTILE USE

The perfect instrument has not been designed nor is it likely to be achieved in the immediate future, but there are certain design parameters that must be considered if an instrument for general textile use is to be eventually achieved. The previous discussion gives a basis for the check list of these as shown in Table I.

However, there are certain considerations that go beyond the capabilities of the instrument designer. These have to do with proper sampling of materials for measurement, proper positioning of sample in the sample port of the machine, intelligent choice of backing for the sample and the proper control of atmospheric conditions for optimum operation of the equipment and the proper conditioning of the sample prior to measurement.

But the most critical factor influencing the design as well as the use of instrumentation for measuring textile surfaces is a need for modifying the basic colorimetric theory to meet the specific surface phenomena of textile materials in general. When one views a colored textile material, what one sees color-wise, under the specific situation and circumstances, is an integrated sensation comprising

TABLE I
Desirable design parameters of a suitable color-measuring device for textile use

Illuminant to correlate with visual practice under Source "D" at an illumination level of 150-250 foot candles.
Capable of changing illuminant to correlate with other sources that can be adequately described.
Geometry of viewing conditions correlating with standard visual practice, that is, approaching 0°-0° directional with some diffuse illumination.
Precision better than five parts in ten thousand or about 0.1 MacAdam unit of color difference.
Sensitivity to be 0.5% of quantity being measured or better, ie, 2% reflectance must be measured to 0.01% absolute.
Measurements to correlate directly with CIE color space or be in a system which can be easily converted to CIE space.
Capable of giving direct readings of color (in the specific color space selected) without requiring external computation.
Capable of direct readings of color difference.
Capable of integrating surface parameters when inter-comparing samples of different surface characteristics.
Capable of integrating surround factors as used in visual practice.
Capable of transmisson as well as reflectance measurements.
Capable of recording spectral reflectance or transmisson with respect to a standard white reference or to record the difference in spectral reflectance or transmission between any two samples.
Capable of recording the difference in "R"—cam functions.
Calibration, standardization and operation to be essentially automatic and simple enough not to require highly trained professional operators.

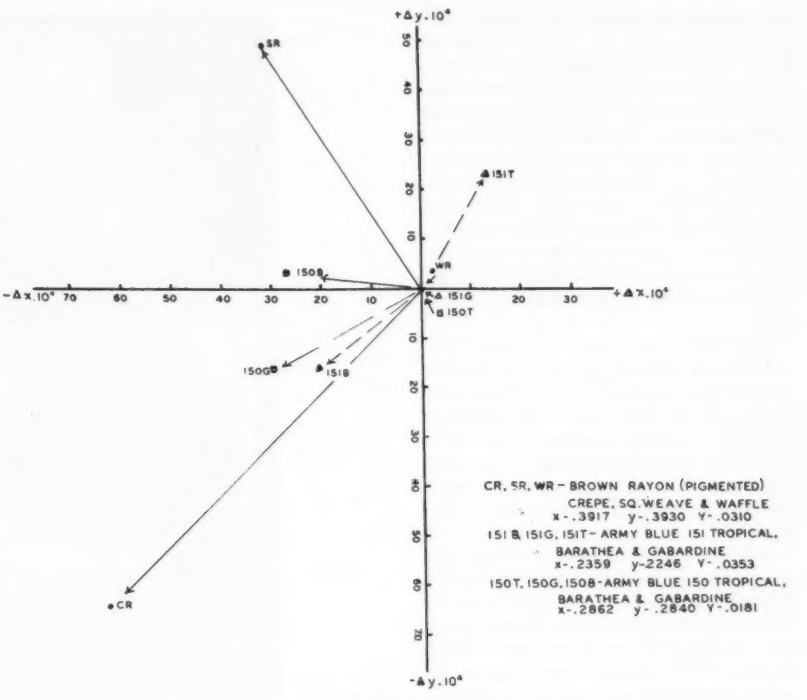

Figure 1
Shifts in colorimetric spacing of shades developed from the same predyed fiber stock on different weave patterns creating different surfaces

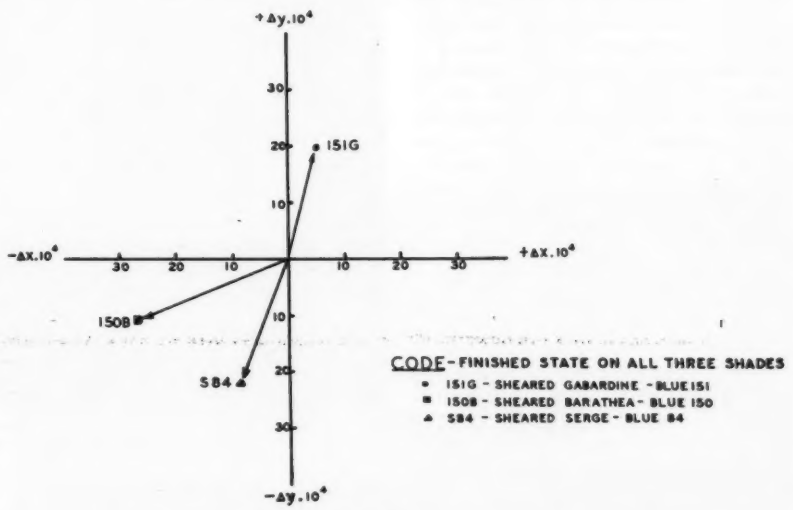

Figure 2
Extent of shift in colorimetric spacing created in wool fabrics by semidecating after shearing

the intrinsic color of the organo-chemical complex formed by the colorant with the fibrous substrate, the color equivalent function of the fabric surface reflectances, absorptions, and other properties, as determined by structural design (weave) and finish, the influence of the surround (4) and the geometry of the illuminating-viewing conditions.

The intrinsic color represents the limiting case in which the surface properties of the material essentially disappear, that is, the surface texture is infinitely reduced so that a true micro-surface is attained without simultaneously acquiring a change in specularity. This might be approximated by extrapolating the curves of the color properties as the surface texture is gradually reduced. At best, this would require rather extensive work to determine.

This color-equivalence function originating with the fabric structure and surface is best illustrated by the case where the same colorants have been applied simultaneously in the same dyebath to two fabrics made from the same lot of fibers, but differing in weave structure. This will invariably give different visual appearances, as seen in Figure 1. This structural difference need not be very great. It can be simply a distortion in the lay of the surface hairs or the extent of the compacting of the surface such as can be seen in wool fabrics between sheared state and the same fabrics after shearing and pressing or decating (Figure 2) as long as conditions are mild enough not to introduce changes in the physico-chemical bonding of dye to fiber or to induce isomerization or thermotropism in the dyes.

The influence of the surround as used in visual color matching has been ignored in instrumental design but is, nevertheless, a very important factor to the human eye. For instance, everyone who has done color matching is aware of the impact of the color of the surface against which the color matching is done upon the ac-

ceptability of a series of samples compared to a standard. It is well known that when the background deviates markedly from the color of the samples, a wider tolerance is permitted, whereas when the background is the standard of reference, the tolerance accepted is considerably narrower. Another facet related to this is the appearance difference observed between two specimens, taken from adjacent areas of the same fabric, yet instruments will not show a difference.

Geometry has been considered and recognized as a factor in what is seen but conformance of the instrumental geometry to that of visual practice has been avoided because of the complications in standardizing the equipment and correlating the end results when the specular component is included.

The problems discussed above are not particularly significant when the absolute color of a sample is to be measured, because this depends on the method of measurement. They become increasingly important as comparisons of relatively or markedly different materials are made. They are especially important in development of shade, extremely so in predicting a tolerance spacing, and significantly so in following the progression of shade change during a manufacturing operation. One assumes, of course, that there is no change in the absolute quantity of dye or colorant. When a shade is produced on a material of given texture, the tristimulus values for the shade may be considered to be defined by the equations:

$$\begin{aligned} X_f &= X_i + X_s + X_g + X_m \\ Y_f &= Y_i + Y_s + Y_g + Y_m \\ Z_f &= Z_i + Z_s + Z_g + Z_m \end{aligned} \quad (1)$$

Where X_i, Y_i, and Z_i represent the intrinsic functions, X_s, Y_s, and Z_s the surface or design functions, X_g, Y_g, and Z_g are the geometry functions and X_m, Y_m, and Z_m represent those due to the surround functions.

If we compare two differently textured fabrics as mentioned above against the common background, under the same illuminating and viewing conditions, it will be seen that the comparative color difference will be the difference in two functions where the surround and geometric factors X_m, Y_m, Z_m and X_g, Y_g, Z_g cancel out and the equation reduces to

$$\begin{aligned} X_{f1} - X_{f2} = dX_f &= (X_{i1} + X_{s1}) - (X_{i1} + X_{s2}) \\ Y_{f1} - Y_{f2} = dY_f &= (Y_{i1} + Y_{s1}) - (Y_{i1} + Y_{s2}) \\ Z_{f1} - Z_{f2} = dZ_f &= (Z_{i1} + Z_{s1}) - (Z_{i1} + Z_{s2}) \end{aligned} \quad (2)$$

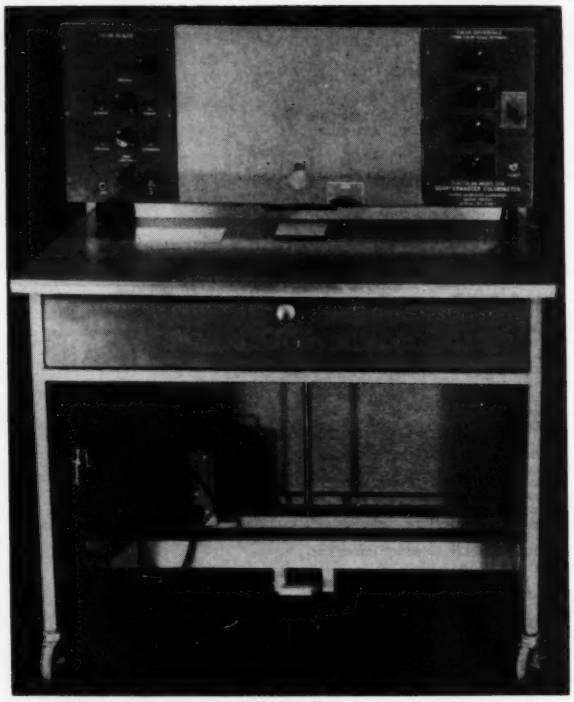

Figure 3a
Quartermaster Tristimulus Colorimeter with large area head

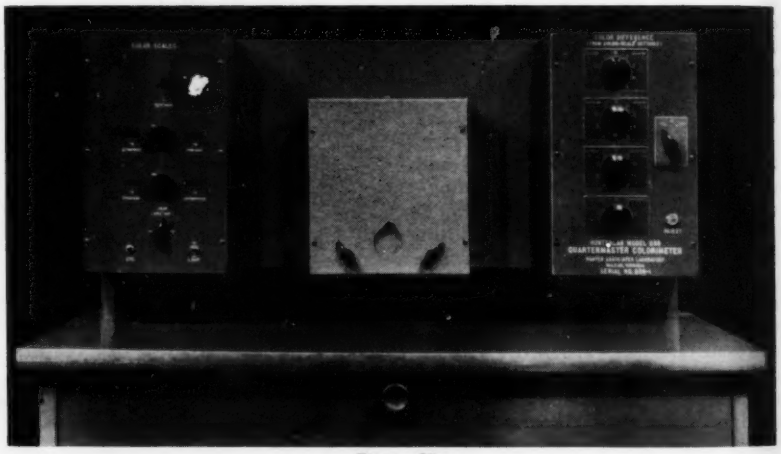

Figure 3b
Small area head of Quartermaster Tristimulus Colorimeter

In the limiting case where the same fibers and dyes were used, essential differences between two samples reduce to that contributed by the differences in the surface texture of the fabric.

In research and development these considerations cannot be ignored. In evaluations and quality control where specific standards of reference have been established, we are usually concerned more with the differences from these standards or from certain values or samples which define either the tolerances or the control limits. Here differences in texture are relatively small or non-existent and the differences are essentially differences in intrinsic color of the two specimens and measurements tend to be more practicable. Thus, color-difference measurements are more useful to this type of activity.

The Quartermaster program in the field of color covers both aspects of the color problem (5). There is the

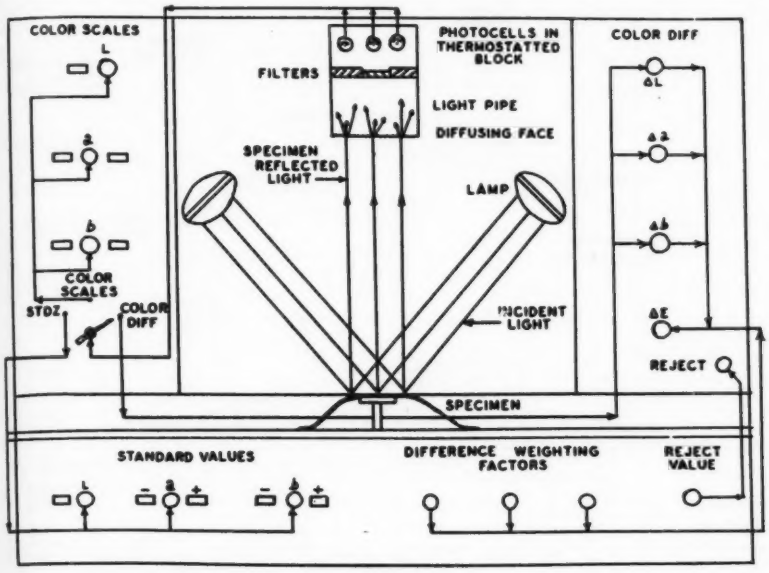

Figure 4
System schematic of Quartermaster Tristimulus Colorimeter

basic problem of color definition for records of the standard shades and the more practical problem of color tolerances, useful in defining acceptance limits in procurements. In the preparation of these latter samples, the whole substance of our prior discussion comes into play.

THE NEWLY DEVELOPED INSTRUMENTS

A DESCRIPTION OF THE INSTRUMENTS——Because in many shade standardization and other color programs, existing instrumentation has made it difficult to distinguish the sources of the errors, as between the aberrations in the theory and in the instrumental design, despite a tight control on other pertinent and applicable parameters, action was taken to attack the problem of instrumentation as the apparently easier approach to a resolution of the contributory factors. By a feasibility study, followed by a development program,* two instruments were produced and subjected to test. The testing is not complete but we know the instruments are not the ultimate possible. In fact, many changes have already become apparent and will undoubtedly be incorporated in later models. Our purpose in discussing them at this time is to demonstrate a trend in the hope that further efforts by all interested in this field will eventually result in more adequate measuring devices capable of better quantitative correlation with visual experience.

The first of these two instruments, the Quartermaster Tristimulus Colorimeter, an automatic color difference meter is shown in Figure 3 and in schematic form in Figure 4. The basic circuitry derives from the color-difference meter reported by Hunter in 1958 (3). However, there have been many changes aside from the automation. The illuminating and viewing conditions have been changed from 45°-0° to 22°-0°, the smallest angle possible with the physical arrangement which is limited by the light pipe introduced to collect the reflected energy. It is pertinent to say that further changes in illuminating-viewing conditions are considered to be possible with new equipment presently under development. The filters have been trimmed (3) to provide with the phototube and light source a correlated color temperature of 7500°K. The specimen port has been increased to a four-inch diameter, although a separate head is available for two-inch and one-inch areas. Color measurements are recorded on the digital readouts on the left panel. Color differences with respect to a standard color, whose values are impressed on the left hand digital readouts, are automatically read on the dials on the right, which give values of Δ_a, Δ_b, Δ_L and Δ_E (in NBS units.)

This instrument was primarily designed to permit a rapid inspection of textile fabrics for color properties, color differences and color loss. This was described at the Optical Society meeting in April 1960 (6).

The second instrument, the Quartermaster Color Analyzer, shown in Figure 5 and schematically in Figure 6, is a visual range recording

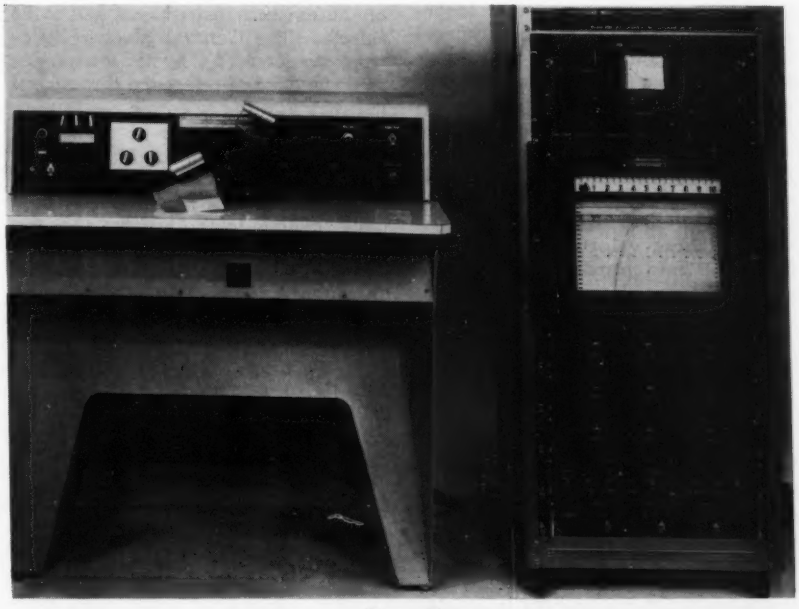

Figure 5
Quartermaster Color Analyzer

*Contractor—Macbeth Corp, Newburgh, NY. Subcontractors—Hunter Associates Laboratory, McLean, Va; Quantametric Devices, Inc, Binghamton, NY.

spectrophotometer capable of both color and color-difference measurements. The essential features of this instrument are nearly 0°-0° illuminating and viewing conditions using a controlled light source, grating monochromator and photo-multiplier detector. A three-beam system is used: Light emerging from the monochromator is directed in turn at a white reference, a material standard and a test specimen. A complete white-standard-test scan cycle occurs every millimicron from 380-720 mu. The voltage representing the spectral reflectance of the test sample is modified by a photo-electrically activated function generator that is attenuated at each wavelength in a manner characteristic of the illuminant it represents and by each of three mechanically driven potentiometers representing the x, y and z functions for the 1931 Standard Observers (2). The integration can be made with respect to any illuminant whose spectral distribution is known. The resulting three signals drive electronic integrators which become charged to voltages proportional to the X, Y and Z values of the samples. By integrating the color differences obtained by comparing a specimen to a material color standard, differences in the tristimulus functions can be recorded. When the standard is a black hollow cup, the readings become the color constants of the specimen itself. From these tristimulus functions, by analog computation, the x and y values of the test sample are displayed on digital readouts. An ink recorder is incorporated to trace the spectral reflectance curve of the sample or the differential curve from that of a standard. Initial attempts to produce differences in the trichromatic values by analog computation were unsuccessful, although further efforts in circuit development are considered to have such a potential. However, calculations of these values are achievable from the data provided by the instrument using the equations:

$$dx = x - \frac{X_2}{A - \Sigma\Delta} \qquad (3)$$

$$dy = y - \frac{Y_2}{A - \Sigma\Delta}$$

Where A is the sum of the tristimulus values of the standard reference and $\Sigma\Delta$ represents the sum of the differences in the tristimulus values of the specimen from the standard, and x and y are the trichromatic coefficients of the standard.

Another method of utilizing the differences in the tristimulus functions has been reported by Wurzburg, DiBernardo and Cleary (7).

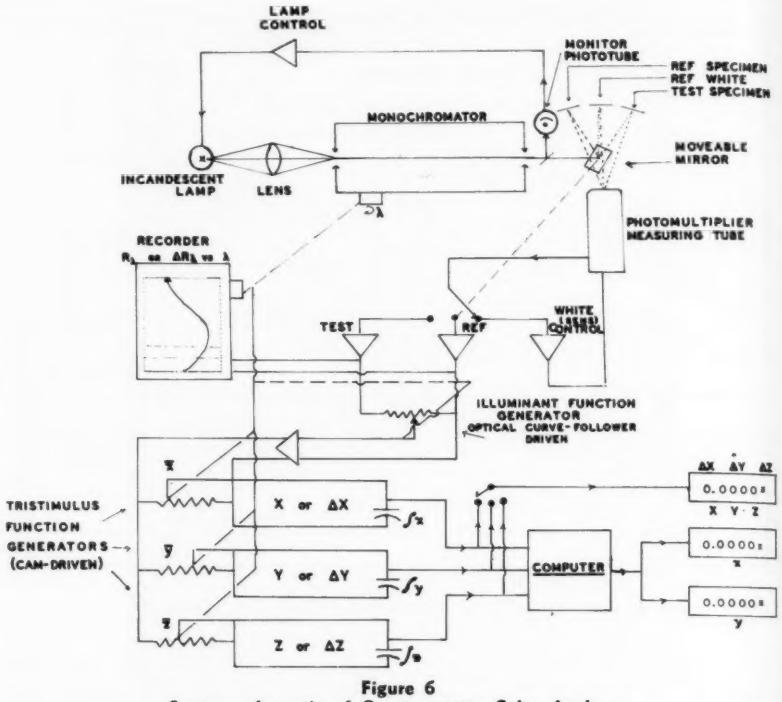

Figure 6
System schematic of Quartermaster Color Analyzer

HOW WELL DO THE INSTRUMENTS PERFORM?——In order to establish a frame of reference against which to compare the performance of the new instruments, one of the existing instruments had to be selected. The General Electric Spectrophotometer (8), by its acceptance as a standard of reference throughout industry and the scientific community generally, appeared to be the logical choice.

Over many years of use on military color problems, it has been increasingly obvious to the authors that the precision of this instrument is better for the lighter colors than for the darker such as are generally used in military items.

To illustrate the degree of precision one may expect with this instrument, even when it is operating at peak performance, as it must be for truly critical measurements, a number of military shade standards were measured in duplicate, using the General Electric Spectrophotometer, each time replacing the sample in the sample port in as nearly the same position as possible. These measurements, as summarized in Table II, reveal that the repeatability of the measurements ranges from 0.5 to 4.0 MacAdam units of color difference, depending upon the absolute reflectance of the specimens.

TABLE II
Average precision of Repetitive Measurements of selected military shades in GE Spectrophotometer
(Source "C"—MgO)

Shade No.	*Nominal reflectance* Y(%)	*Average change in reflectance repetitive measurements* Δ Y(%)	*Change in chromaticity* Δ C *MacAdam*	*Color difference* Δ E *MacAdam*
Blue 150	1.6	.08	0.4	1.8
AG 44	4.5	.06	0.9	1.1
OG 108	7.5	.11	0.5	0.9
Taupe 79	11.0	.60	0.4	0.5
Blue 157	2.0	.07	2.8	3.6
Blue 85	2.7	.06	0.9	1.2
Blue 84	5.0	.04	0.5	0.7
Blue 515	29.0	.58	0.7	0.9

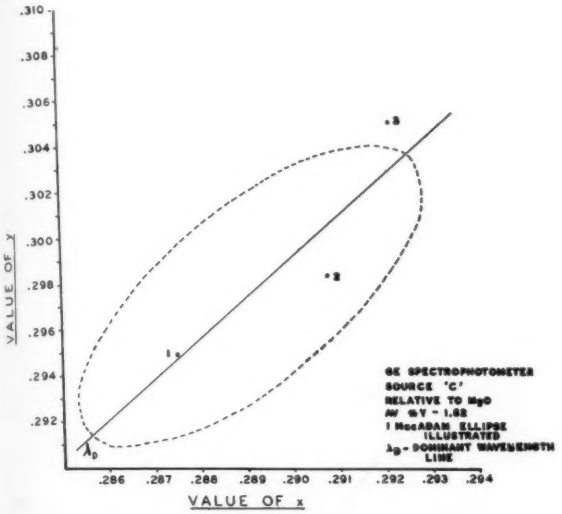

Figure 7
Relative placement in chromaticity plane of three separate readings of standard—Army Blue 150

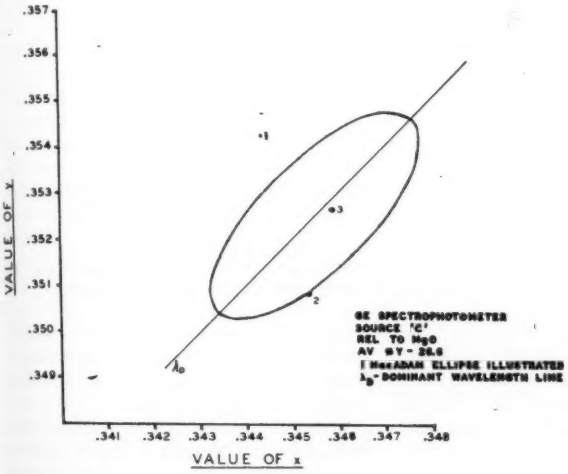

Figure 8
Relative placement in chromaticity plane of three separate readings of standard—Tan 505

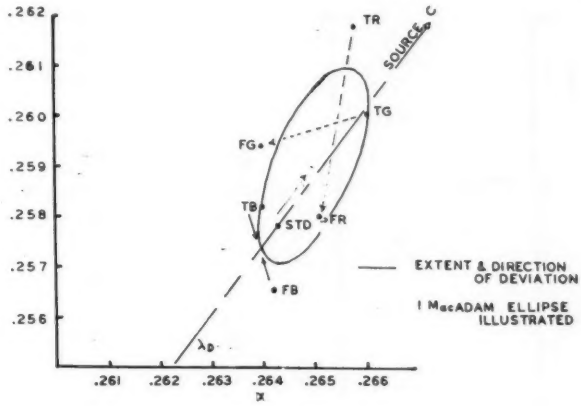

Figure 9
Colorimetric spacing of tolerances 18-oz Serge Blue 84

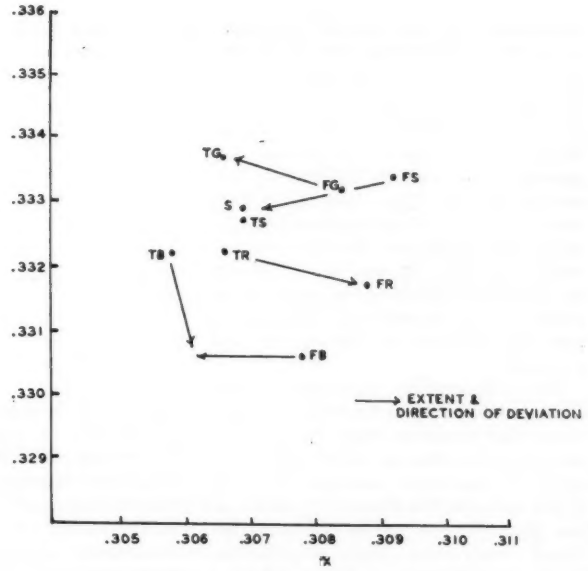

Figure 10
Colorimetric spacing of tolerances 16-oz Serge Army Green 44

To establish the significance of these values to the measurement problems of our laboratory, we chose to reference this error to the extent of the difference in shade that we attempt to measure in military textiles. For this purpose, there are displayed in Table III data obtained with the General Electric Spectrophotometer illustrating the average deviation of shade tolerances from their respective standards. While the values shown may be somewhat uncertain due to the instrumental limitations in precision mentioned above and to other errors as described by Nimeroff (*9*), and more recently by Wyszecki (*10*), it can be seen that the size of the errors in repetitive measurements approximates the size of the average military shade tolerance.

This uncertainty, caused by lack of adequate precision, becomes especially significant when data such as that illustrated in Figures 7 and 8 are considered. In these, two different standards were read at three separate times under as nearly reproducible conditions as possible, averages of several measurements being recorded each time. It is obvious that such a

TABLE III
Average differences in colorimetric constants of selected military shade tolerances from respective standard
(Source "C"—MgO—GE Spectrophotometer)

Shade No.	Constants for standard			Average differences			ΔC	ΔE
	x	y	Y	Δ±x	Δ±y	Δ±Y	MacAdam	MacAdam
Tan M1	.3571	.3604	.2214	.0009	.0011	.0064	1.0	1.5
AG 44	.3031	.3329	.0483	.0012	.0008	.0015	1.5	2.1
Blue 150	.2840	.2826	.0161	.0034	.0044	.0004	2.7	2.9
Sage Green 522	.3052	.3213	.1065	.0018	.0014	.0076	1.1	1.7
Blue 84	.2635	.2577	.0830	.0011	.0011	.0017	1.3	1.9
OD 7A	.3428	.3680	.0701	.0011	.0011	.0033	1.1	1.8
Blue 324	.2498	.2330	.0244	.0014	.0012	.0016	1.8	2.4
Silver Tan 143	.3399	.3431	.2806	.0016	.0027	.0132	1.7	2.2
Blue 157	.2605	.2513	.0284	.0037	.0050	.0022	4.5	5.3
Blue 85	.2548	.2402	.0303	.0018	.0018	.0021	1.6	2.8

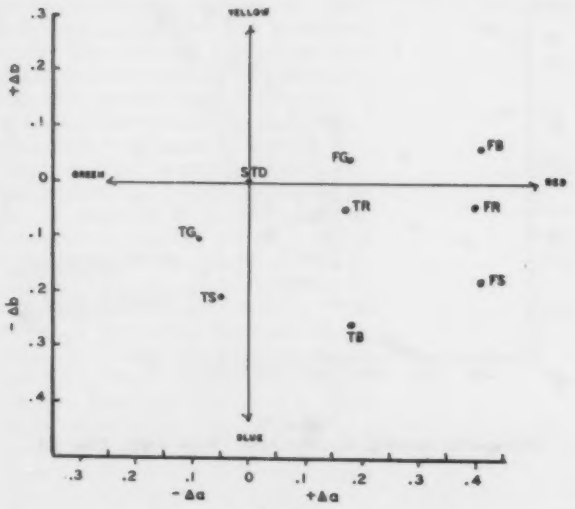

Figure 11
Colorimetric spacing (Hunter) of shade tolerances Army Green 44 as determined with QM Tristimulus Colorimeter

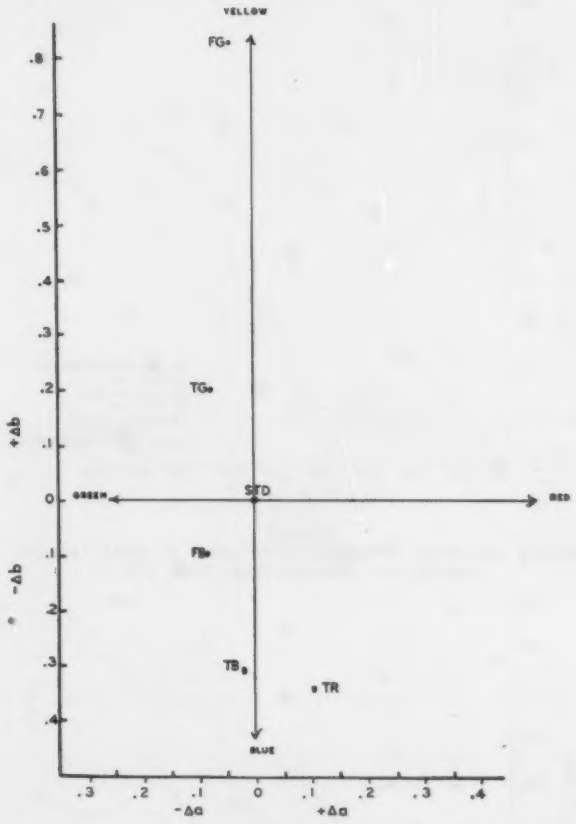

Figure 12
Colorimetric spacing (Hunter) of shade tolerances Blue 84 as determined with QM Tristimulus Colorimeter

large spread in colorimetric values for the standard not only creates difficulty in establishing a specific locus for it in color space, but further aggravates the problem in spacing tolerance limits. The illogical colorimetric spacing of the apparently visually well balanced shade tolerance ranges for Blue 84 and AG 44 shown in Figures 9 and 10 lends further emphasis to the uncertainty originating with the instrumental limitations and precision.

The comparative precision for the Quartermaster Tristimulus Colorimeter illustrated in Table IV, and reported as the average color-difference error in repetitive measurements, is of the order of 0.3 MacAdam units, or less than the low value of the range found with the General Electric Spectrophotometer. This finding achieves significance when it is recognized that to reproduce a military shade standard to a level that maintains visual continuity of the color as originally adopted, and that at the same time, is capable of coping with all aspects of procurement actions, the maximum deviation between a developed standard and the original master standard must be less than 0.3 NBS units of color difference (1/3 commercial tolerance) or about one MacAdam unit. The improved precision demonstrated by the Quartermaster Tristimulus Colorimeter now permits not only more accurate and precise definition of the loci of samples in color space, but also contributes to a possible separation of the errors due to nonmeasurement causes from those due to instrument and method of measurement.

Evidence of this effect can be seen in Figures 11 and 12, which represent measurements with the Quartermaster Tristimulus Colorimeter of the same specimens which were originally shown in Figures 9 and 10. The loci of the individual tolerances are not only better spaced around the standard but are more consistent with visual judgment for both shades. The tolerances represented in these two instances were originally selected visually from production and were not produced by present day techniques of tolerance spacing and as such, may have been subject to some color preference (*11*) and other factors associated with visual judgment. The important consideration is that the instrument is capable of bringing instrumental and visual judgment into closer harmony.

The precision of measurements with the Quartermaster Color Analyzer is demonstrated in the data re-

TABLE IV
Average precision of repetitive measurements of selected military shades on Quartermaster Tristimulus Colorimeter
(Source "D"—22°-0°—Vacuum Tube)

Shade No.	*Hunter values*			*Average change in values repetitive measurements*			*Color difference*	*Color difference*
	L	*a*	*b*	Δ *L*	Δ *a*	Δ *b*	Δ *E NBS*	Δ *E MacAdam*
Blue 150	13.6	−0.5	−2.9	.06	.08	.08	0.1	0.3
AG 44	18.9	−1.7	1.1	.02	.10	.10	0.1	0.3
OG 108	26.9	−3.5	5.0	.04	.06	.02	0.07	0.2
M-1	46.6	−1.5	8.3	.08	.25	.16	0.3	0.9*
5 GY 3/4	29.1	−4.8	4.6	.00	.10	.00	0.1	0.3
N-4	34.8	−1.0	2.1	.00	.10	.00	0.1	0.3
5 R 4/4	35.1	9.3	3.6	.07	.00	.00	0.07	0.2
N-5	43.7	−1.5	−2.2	.00	.07	.00	0.07	0.2
5 GY 5/4	43.8	−10.4	12.4	.00	.05	.00	0.05	0.15

*Shade slightly fluorescent

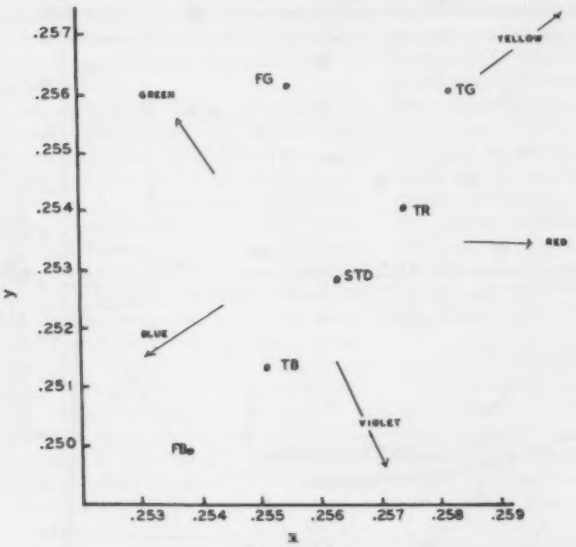

Figure 13
Colorimetric spacing (CIE) of shade tolerances Blue 84 as determined with QM Color Analyzer

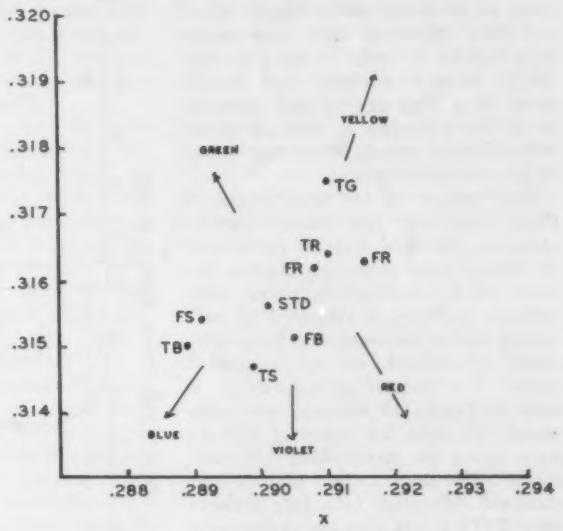

Figure 14
Colorimetric spacing (CIE) of shade tolerances Army Green 44 as determined with QM Color Analyzer

corded in Table V. It will be noted by reference to the data of Table II that this precision is substantially better than from the General Electric Spectrophotometer and is about the same as the precision with the Quartermaster Tristimulus Colorimeter. This improvement in precision over existing instruments gives the hope of reducing the errors in the definition of shade standards and the very important areas of shade tolerance development upon which the degree of quality control in production of military textiles is essentially predicated. This improvement in precision certainly has favorable implications for the important work that the industry is required to perform, not only in supplying the Armed Forces, but in adequately satisfying civilian customers, and, in particular, the discriminating public.

As with the Quartermaster Tristimulus Colorimeter, the improvement in precision shown by the Quartermaster Color Analyzer is found to improve the color spacing of tolerances and to bring the loci of these more in consonance with visual judgment. An interesting comparison becomes possible by studying the data in Figures 9 and 10, which were obtained with the General Electric Spectrophotometer and those of Figures 11 and 12, which were obtained with the Quartermaster Tristimulus Colorimeter with the data illustrated in Figures 13 and 14 obtained with the Quartermaster Color Analyzer. The samples in all three cases were the same. The improvement in color spacing is obvious.

TABLE V
Average precision of repetitive measurements of selected military shades in Quartermaster Color Analyzer
(Source "C"—MgO)

Shade No.	*Nominal reflectance Y(%)*	*Average change in reflectance repetitive measurements* $\Delta Y(\%)$	*Change in chromaticity* ΔC *MacAdam*	*Color difference* ΔE *MacAdam*
Blue 157	2.5	.004	0.3	0.3
Blue 150	2.2	.003	0.3	0.3
Tan M-1	24.0	.05	0.8	0.8
AG 44	4.7	.005	0.4	0.4
OG 107	7.0	.008	0.3	0.3

TABLE VI
Comparative consistency of data for GE Spectrophotometer and Quartermaster Color Analyzer using Munsell Paper Standard

Munsell notation	*NBS recorded values (12)*			*GE Spectrophotometer*			*QM Color Analyzer*		
	x	*y*	*Y*	*x*	*y*	*Y*	*x*	*y*	*Y*
5P 6/6	.291	.251	.318	.297	.260	.322	.294	.258	.316
10R 6/6	.416	.350	.338	.415	.350	.330	.415	.356	.350
10B 6/6	.241	.270	.332	.243	.274	.323	.248	.266	.329
5G 6/6	.260	.387	.304	.269	.383	.303	.262	.366	.289
5P 4/4	.298	.257	.128	.301	.254	.127	.310	.265	.134

As previously mentioned, the optical geometry of the Quartermaster Color Analyzer is directional, whereas in the General Electric Spectrophotometer diffuse conditions exist. The extent of the effect of this difference in geometric relationship between illuminator, sample and detector is recorded in the data of Table VI. In general, these data show an increase in reflectance over the General Electric data created by the inclusion of the specular component; also a reorientation in the colorimetric spacing that brings the instrumental and the visual qualitatively more in harmony.

Further improvement is seen by a study of the data in Table VII, which compares the colorimetric constants, obtained with the Quartermaster Color Analyzer, under Illuminant "C" and "D". The improvement in correlation with the Illuminant "D" suggests that part of the improvement over the results with the General Electric Spectrophotometer may be ascribed to the use of the same illum-

inant as in visual assessments. Munsell color standards were used rather than fabrics in order to have a relatively smooth surface that would avoid to a high degree any question as to the influence of texture under the different optical geometry found in the two instruments.

One feature of the Quartermaster Color Analyzer has special significance in research and, in particular, in critical color matching studies because of the manner in which differences between a standard of reference and a specimen can be graphically illustrated on an expanded scale. This improved sensitivity is seen in Figure 15 wherein are compared not only the spectral reflectance curve for Army Blue 150 (absolute reflectance 2.23%) and its thin standard tolerance (absolute reflectance 2.38%), but also the differences of one specimen from the other on a ten times expanded scale. These two curves of the differences appear in an essentially mirror image depending upon which was placed in the reference port of the machine. (We recognize some deviations in symmetry due to geometric aberrations but these are correctable). This interchangeability of standard reference and test specimen permits a check on performance and increases the accuracy of the measurements.

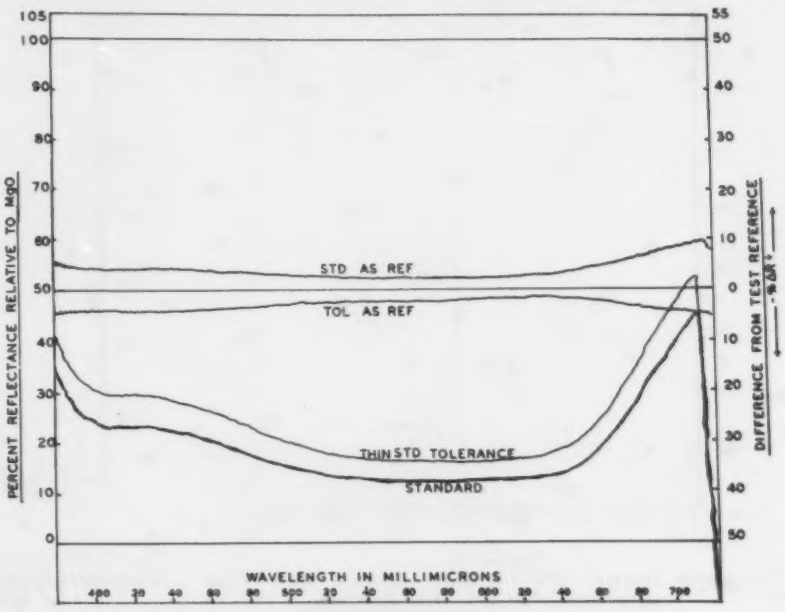

Figure 15
Comparative spectral reflectance characteristics of tolerance and shade standard—Army Blue 150—Quartermaster Color Analyzer

RECAPITULATION, DISCUSSION AND CONCLUSION

Thus, in the preceding paragraphs, an attempt has been made to define the problems confronted in the measurement of textile fabrics as related to the applicability of the basic theory, the performance characteristics of the available measuring instruments, and the influence of the viewing conditions used in instrumental practice on correlations with ratings obtained by visual inspection. Two new instruments have been described that appear to have properties possibly leading to the eventual resolution of the inherent instrumental problems, but it must be recognized that improvements in these devices are possible and must be made if truly satisfactory instrumentation is to be achieved. The precision and reliability that has been demonstrated in these new instruments provide a hope for an early and more extensive use of color measuring devices in military color programs and in the control of process and product in the industry. Already these instruments are assisting in the problems of shade standardization and tolerance development of military colors in a manner which has not been possible heretofore. (Because of the problems with the measuring instruments as detailed above).

A thorough analysis of what has been achieved to date suggests that so long as these instruments are used for intercomparisons between given materials and related standards, the data supplied by them will be reasonably realistic in relation to visual experience. However, as the surface properties of the materials being examined diverge in one measure or another from those of a given standard, under the existing theory, the results will be in error to a degree that for truly critical programs will still be excessive. For the present, under these conditions, the appearance of a given color on a material of different surface characteristics cannot be predicted except by empirical methods. This is one problem that faces not only the military, but also is of great importance to the industry.

It is appropriate to re-emphasize that instrumental and visual correlation can only be possible when the factors that contribute to what the human eye sees have been adequately weighted in the instrumental procedure. It must be recognized that there is one factor of extreme importance in the correlation between instrumental and visual. This has to do with the reproducibility in the presentation of the specimen to the color measuring machine. This still remains as one of the truly critical unresolved problems in color measurement of textile surfaces. There is, accordingly, an urgent need for further research on the specific surface phenomena presented by textile fabrics and some of this is at a very fundamental level. There is also a need for instrumental design studies

TABLE VII
Relative colorimetric constants of military shade standards obtained with Quartermaster Color Analyzer under Sources "C" and "D"

Shade	*Source "D"*			*Source "C"*		
	x	*y*	*Y(%)*	*x*	*y*	*Y(%)*
Olive Green 107	.3390	.3539	6.34	.3505	.3726	7.50
Army Green 44	.2962	.3066	4.07	.3058	.3238	4.70
Army Blue 150	.2832	.2595	2.17	.2872	.2808	2.23
Army Tan M-1	.3518	.3396	22.52	.3616	.3613	24.32

that will incorporate features which take into account some of the psychophysical phenomena contributing to visual values.

An analysis of the potentialities of the two new instruments leads to the conclusion that the Quartermaster Color Analyzer has a potential in research and development and more limited usefulness in control, while the Quartermaster Tristimulus Colorimeter contains an innate versatility which makes it useful in research and development but especially so in quality and production control. However, the Quartermaster Color Analyzer is adaptable to basic modifications which might in time lead to a family of related instruments capable of application in the solution of many types of color problems.

In concluding, it is cautioned that no intent is implied or is to be assumed that the instruments in question will find immediate usefulness in Industry-Government transactions, nor is it to be implied that the fact that the Quartermaster Corps has sponsored the development of these instruments automatically authorizes the use of these instruments to resolve questions which may arise out of Government-Industry transactions.

While it is the hope that eventually these or other instruments may be used in the definition of military textile color standards and possibly of acceptance limits, such use is not appropriate at this time and is subject to substantially more testing than has been accomplished to date.

However, it is pertinent to state that one of the basic reasons for the sponsorship of the development of these instruments, aside from their immediate usefulness in research and development, is in the hope that a more objective system of color definition and color control for textiles may eventually become possible.

ACKNOWLEDGMENTS

The authors acknowledge the assistance of Ruth J Evans of their staff, who made several of the measurements and calculations reported. Much is owed to the helpful ideas and support received from Richard S Hunter, Hunter Associates Laboratory, in whose hands the development of the Tristimulus Colorimeter became possible; also to Monroe H Sweet of Quantametric Devices Company, who married Quartermaster-generated ideas and intricate electronics into the Quartermaster Color Analyzer. A great deal is owed also to Norman Macbeth and Warren Reese of Macbeth Corp, the prime contractor in the development of both instruments, not only for their advice, but also for their keen interest in seeing that the best possible was achieved. However, the development reported could not have been made without the active support and confidence of the authors' chief, Dr S J Kennedy, chief, Textile Clothing & Footwear Division, and of many others in responsible positions in both the Quartermaster Research and Engineering Command and the Office of the Quartermaster General.

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NOMINEES FOR NATIONAL OFFICERS—1962

THE following slate of officers for 1962 was announced at the Council meeting in Durham, NC, on April 21, 1961:

For President: Elliott Morrill, Corn Products Co, Indianapolis, Ind

For Vice Presidents:

New England Region: J Edward Lynn, technical consultant, Old Greenwich, Conn

Central Atlantic Region: William S Sollenberger, American Viscose Corp, Marcus Hook, Pa

Southern Region: Joe D Mosheim, Crystal Springs Bleachery, Chickamauga, Ga

Leonard Smith, National Cotton Council of America, Washington, DC

Western Region: Joseph H Jones, Phoenix Dye Works, Cleveland, O

Activities of the Local Sections

(Photos by Edward Artim)

Metropolitan Section Vice Chairman Richard P Monsaert Jr (left), American Felt Co, who presided at the April meeting of the Metropolitan Section in the absence of Chairman P J Fynn, is shown with guest speakers Lucille Rae, Simplicity Pattern Co, Inc, and John D Robertson Jr, Mount Hope Machinery Co, Inc

Speakers are questioned following their presentations at the Metropolitan Section's April meeting

Metropolitan

"THE Importance of Bow and Skew" was discussed by Lucille Rae, educational director for Simplicity Pattern Co, Inc, New York, NY, and John D Robertson Jr, president of Mount Hope Machinery Co, Inc, Taunton, Mass, at the April 21st meeting of the Metropolitan Section, held at Kohler's Chalet, Rochelle Park, NJ.

"Bow and Skew" is the textile industry term for it; but to the unhappy consumer it is a problem of grainline, hang of dress, fabric designs and patterns printed 'off grain'. After battling this problem with one dress, the consumer is not so enthusiastic about buying a similar type of fabric for the next endeavor—if she still has a desire to endeavor at all.

In connection with this problem, Miss Rae showed a film dealing with one process commonly used by the consumer for straightening fabric pressed "off grain". Following this, a report was given on how the consumer who sews and the teacher who is instructing sewing students regard the problem of present-day "off-grain" fabrics.

Mr Robertson showed a film on plant methods for straightening fabric and discussed both the optical and mechanical processes for obtaining "on-grain" fabrics. This film, entitled "The Skew Liner", illustrates an electro-mechanical detection principle of one of Mount Hope's automatic controls.

•

Hudson-Mohawk

A total of 70 members of the Hudson-Mohawk Section visited the facilities of General Electric's Silicone Products Department, Waterford, NY, on Friday, April 14.

Included in the program was a tour of manufacturing facilities, followed by dinner at the Mansion restaurant in Waterford. Frank C Bunk, finished products manager, served as the dinner speaker and spoke on the subject "Silicones and You".

In charge of the program were D V Brown, manager of silicone fluids market development at the Waterford plant, and Herbert Leavitt, a specialist on the use of silicone fluids in the textile industry.

During the business session at the meeting, the following were elected to serve as officers during the 1961-2 year:

Chairman—Achilles S Mafilios, Ritter Chemical Co, Inc

Vice Chairman—Armand DiMeo, Lee Dyeing Corp

Secretary—Anthony Cassetta. Mohasco Industries

Treasurer—Walter Drautz, General Aniline Works.

•

South Central

SOUTH CENTRAL SECTION held its spring meeting at the Hotel Patten, Chattanooga, Tenn, on Saturday, April 15, with approximately 60 persons in attendance. Jim Turner Dixie Mercerizing Co, was the sectional committeeman in charge.

Lowell Shive, Arnold, Hoffman & Co, Inc, vice chairman, presided at the afternoon technical session, which featured a talk by Richard A Howarth, Technical Service Dept, Arnold, Hoffman & Co, Inc, on the subject "Fiber-reactive Dyes—The New Frontier".

A social hour, with William O Neeb, National Aniline Co, and Jack Martin, Geigy Dyestuffs, in charge, preceded the evening banquet, at which Chairman R J Tyrrell, Peerless Textiles, presided. Entertainment at the banquet was offered by a local magician.

Plans for the Section's summer outing, to be held June 16-17 at the Riverside Hotel in Gatlinburg, Tenn, are nearing completion. Robert Krauss, Solvay Process Div, will serve as outing chairman.

•

Delaware Valley

DELAWARE VALLEY SECTION held its Sixth Annual Ladies Night Meeting on Friday, April 14, at the Cherry Hill Inn, Merchantville, NJ, with 282 members and guests in attendance at a most successful affair.

Following a cocktail hour, those in attendance were treated to an hour-and-one-half of entertainment as supplied by Ken Barry, Doris Hart, The Warners, Charles Dauber and Tony Desmond and his orchestra.

Dancing lasted until one in the morning.

The Committee which handled the program consisted of Clarence A Seibert, Scholler Bros, Inc, Delaware Valley Section chairman; Walter W Gleadall, Textile Chemical Co, entertainment; Joseph J Murphy, Laurel Soap Mfg Co, dining; Francis A Mather, Para-Chem, Inc, publicity; and Louis R Croce, National Aniline Div, printing.

LADIES NIGHT MEETING

DELAWARE VALLEY SECTION

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APRIL 14, 1961

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CHERRY HILL INN, MERCHANTVILLE, NJ

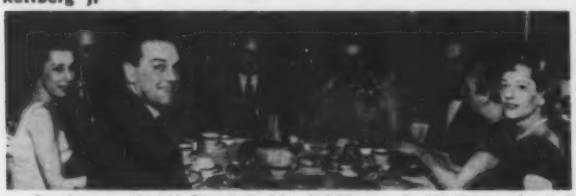
Seated, l to r: W O Goulden, R E Hill, Mrs E Empting, E W Empting, Mrs T McGinn, Mrs N P Jensen
Standing, l to r: Mrs W O Goulden, G Schinke, Mrs G Schinke, N P Jensen, Thos McGinn

Clockwise: C H Schuettler, Mrs C H Schuettler, Mrs E H Walls, E H Walls, Mrs R A Walker, Mrs L O Koons, L O Koons, T M Swoyer, Mrs T M Swoyer

Clockwise: Mrs F J MacDonald, Jacqueline Herpel, Jacob Knup III, Mrs J J Murphy, J J Murphy, Mrs A M Godley, A M Godley, F J MacDonald

L to r: Mrs E E Rettberg Jr, J L Wauters, Mrs J L Wauters, Mrs J W Fidler, F L Fuges, Mrs F L Fuges, Jay W Fidler, E E Rettberg Jr

L to r: Mrs M Smylie, Jack Leahy, Patricia Noblitt, Mrs D W Robinson, D W Robinson, John McCarter, Mrs J McCarter, E Gibbons.



Clockwise: W W Gleadall, Mrs W Kamarek, W Kamarek, A B Helm, Margaret Hays, G Brambani, Mrs G Brambani, Mrs W W Gleadall

Clockwise: E C Diehl, Mrs E Diehl, W S Sollenberger, Mrs W S Sollenberger, W H Bertolet III, Mrs W H Bertolet III, G E Prime, Mrs G E Prime, G J Booth, Mrs G J Booth

L to r: F J DeMaria, Mrs C N Kuzma Jr, C N Kuzma Jr, K E Hankins, Mrs K E Hankins, Mrs F A Mather, Mrs F J DeMaria

Clockwise: C A Seibert, Mrs M Frank, M Frank, Mrs E A Gleadall, E A Gleadall, Mrs R Newman, R Newman, Mrs E C Dreby, E C Dreby, Mrs G P Paine, G P Paine, Mrs C A Seibert

Left half of banquet hall

Right half of banquet hall

AATCC Calendar

COUNCIL; NATIONAL COMMITTEES

Sept 26 (Statler Hotel, Buffalo, NY); Council (8 PM)

Oct 27 (Sheraton Hotel, Philadelphia, Pa); TCR, research and administrative committees

Nov 17 (Hotel Sherman, Chicago, Ill); Council and Annual Meeting (2 PM)

Jan 26 (Hotel Commodore, New York, NY); Council (10 AM)

Apr 13 (Francis Marion Hotel, Charleston, SC); Council, administrative and research committees

NATIONAL CONVENTIONS

Sept 27-29, 1961 (Hotel Statler, Buffalo, NY); 1962 (Atlanta Biltmore Hotel, Atlanta, Ga); 1963—Boston; 1964—New York; 1965 (Conrad Hilton Hotel, Chicago, Ill); 1966 (Philadelphia, Pa)

DELAWARE VALLEY SECTION

May 19 (Outing—North Hills CC, North Hills, Pa); Sept 15 (Wilmington, Del); Oct 27, Dec 1 (Beck's Restaurant, Philadelphia, Pa)

HUDSON-MOHAWK SECTION

June 23 (Outing—Antlers Club, Amsterdam, NY)

METROPOLITAN SECTION

May 19—(Kohler's Swiss Chalet, Rochelle Park, NJ—Ladies Night).

MID-WEST SECTION

June 24 (Annual Outing—Ceramí's Island View Resort, Burlington, Wis); Nov 18 (Chicago, Ill)

NIAGARA FRONTIER SECTION

May 18 (Buffalo, NY)

NORTHERN NEW ENGLAND SECTION

Sept 8 (Annual Outing); Oct 20 (Quartermaster R & E Command, Natick, Mass); Dec 18 (Motel 128, Dedham, Mass); Jan 19 (Woodlawn Country Club, Newton, Mass)

PACIFIC NORTHWEST SECTION

May 26; Aug 5 (annual outing); Nov 10 (business meeting)

PACIFIC SOUTHWEST SECTION

May 19, Sept 30 (outing), Nov 17

PALMETTO SECTION

June 8-10 (joint outing with Piedmont Section at Grove Park Inn, Asheville, NC); Sept 15-16 (Clemson House, Clemson, SC); Jan 20-21 (Poinsett Hotel, Greenville, SC); April 14-15, 1962 (Francis Marion Hotel, Charleston, SC)

PIEDMONT SECTION

June 9-10 (Outing, Grove Park Inn, Asheville, NC); Sept 23 (Hotel Barringer, Charlotte, NC)

RHODE ISLAND SECTION

June 23 (Outing); Sept 15 (Management Meeting); Oct 17 (Dinner Meeting); Dec 1 (Annual Business Meeting)

SOUTH CENTRAL SECTION

June 16-17 (Summer Outing—Riverside Hotel); Sept (Hotel Patten—tentative)

SOUTHEASTERN SECTION

June 9-10 (Summer Outing, Radium Springs, Albany, Ga); Sept 9 (Ida Cason Gardens, Pine Mountain, Ga); Nov 25 (Atlanta Athletic Club, Atlanta, Ga)

WESTERN NEW ENGLAND SECTION

May 19 (Ladies Night—Rapp's Paradise Inn); June 9 (Annual Outing); Sept 15 (Plant visitation); Oct 27 (Annual Meeting); Dec 1 (Shelton, Conn)

Employment Register

This column is open for two insertions per year, per member, without charge. Blanks may be obtained from, and filed with, the secretary of the Association, Post Office Box 28, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the secretary.

61-11

Education: BS, textile chemistry; US Navy officer.
Position desired: Textile chemist; application and development of textiles and related products.
Location: Northeast preferred; no limitations.
Age: 24; married, one dependent; excellent references.

5-1, 5-15

61-12

Education: BS degree.
Position desired: Textile chemist, colorist and/or lab supervisor.
Location: Anywhere in the US.
Age: 47; married; references.

5-1, 5-15

61-13

Education: BS, Lowell Technological Institute.
Position desired: Technical sales and service or chemical development.
Location: Mid-West, West desired; South, Northeast acceptable.
Age: 23; single; excellent references and resume.

5-1, 5-15

SUPPLIERS and friends of the Textile Industry are again being reminded of the AATCC National Convention in Buffalo this fall. The Convention features unusual attractions for the Membership. The expected large attendance and the centralization of hotel and show room facilities present a very desirable opportunity for exhibitors to display their products and services to a select audience. A substantial part of the available area has already been allocated but choice booth space is still available. The Committee urges that those interested in obtaining booth space for an exhibit make reservations as soon as possible.

Participation in the form of exhibits will make this 40th Anniversary of the Association a memorable occasion, and should present firms with many opportunities for future sales contacts.

For further information, contact Frederic Sievenpiper, exhibits chairman, National Aniline Div, 1051 South Park Ave, Buffalo 10, NY.

A limited supply of the following publications are available from AATCC National Headquarters, PO Box 28, Lowell, Mass:

AATCC Test Methods, Part 3, *1960 Technical Manual*, 130 pages —$2.00 per copy

List of American-made dyes, arranged alphabetically by trade name, under *Colour Index* generic names, and by prototype numbers, 130 pages—$2.00 per copy

List of textile chemical specialties, 180 pages—$2.50 per copy

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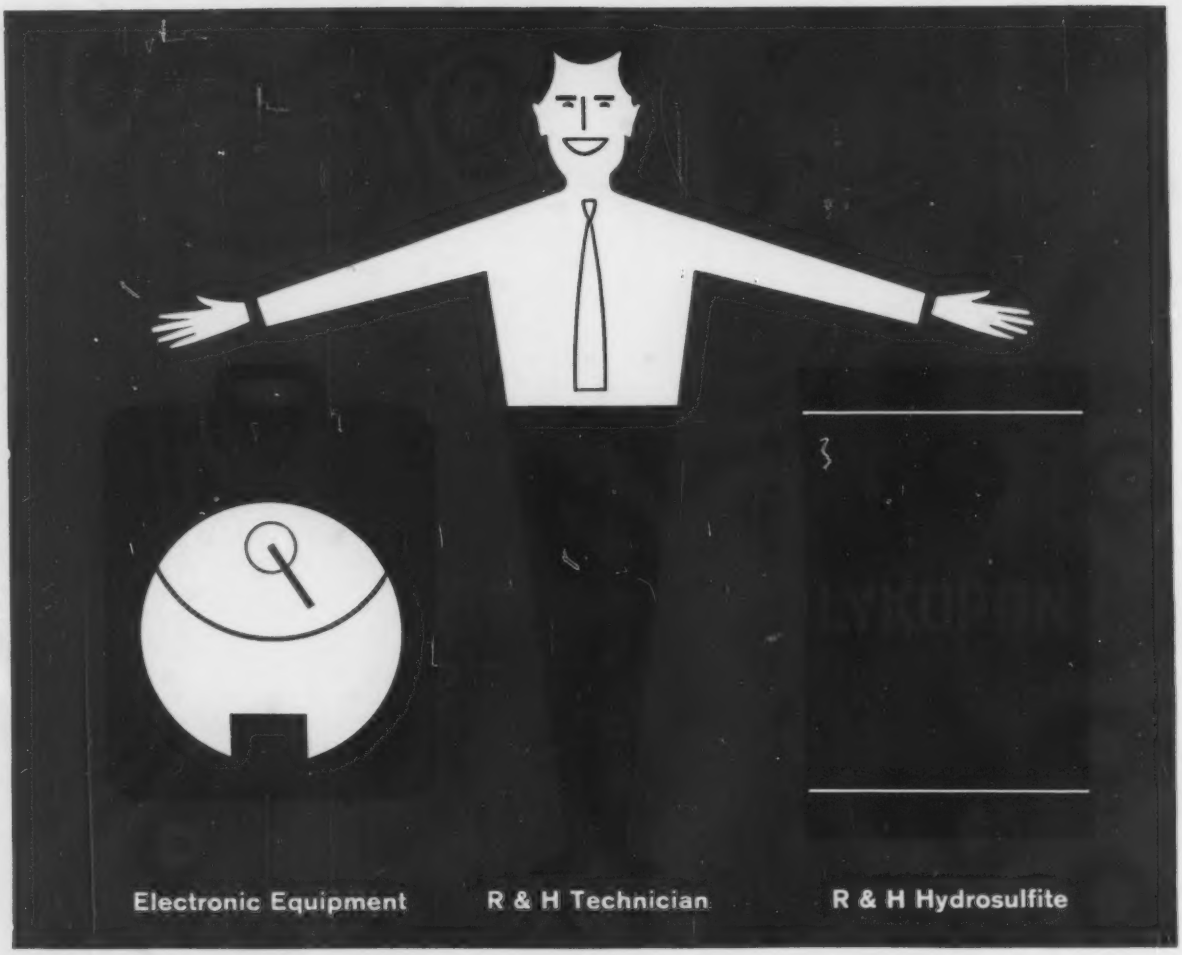

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ADR News Report:

General News of the Industry
Personalities in the News
New Products, Developments, Processes

DuPont to Establish New Dyeing and Finishing Lab in Charlotte

A modern dyeing and textile finishing laboratory which will provide improved technical services to Du Pont customers throughout the South will be established in Charlotte, NC, by the company's Dyes and Chemicals Division.

The new laboratory will be housed in a one-story building immediately adjacent to the warehouse, which services customers of the Dyes and Chemicals Division as well as those of other Du Pont sales groups. Du Pont will lease the building and install in it a variety of dyeing and textile finishing equipment.

"When completed early this fall, the new technical service laboratory will enable us to improve the scope of our customer assistance activities and to provide fast technical service," said Robert D Sloan, manager of the southern district for Du Pont's Dyes and Chemicals Division. The southern district extends from southern Virginia to Florida and includes parts of Oklahoma and Arkansas.

"Many innovations in the field of dye applications and textile finishing have originated in Du Pont service laboratories," Mr Sloan said. "Our new southern district laboratory will be equipped and staffed to service such Du Pont-developed processes as the pad-steam, Thermosol coloration of synthetic fibers, sponge core dyeing, and Unifog spray finishing," he added.

Du Pont has been in the dyes and related chemicals business since the manufacture of synthetic dyes was first begun in this country and has kept pace with the development of the textile and paper industries in the South, Mr Sloan said. The first salesman assigned to what is now the Dyes and Chemicals Division southern district was employed in 1919. The entire Charlotte staff in 1920 consisted of a manager, three salesmen, two warehousemen, a laboratory operator and a clerical worker.

Today, said Mr Sloan, Du Pont's Dyes and Chemicals Division has 93 employees in the southern district working out of two offices, one in Charlotte and the other in Atlanta.

Both offices are presently equipped with laboratories. The work of the existing Charlotte office laboratory will be taken over by the new expanded service laboratory. The Atlanta office will continue to operate a small laboratory, but will transfer many of its activities to the new Charlotte laboratory.

•

Oronite Ships First Maleic Anhydride from California

The Oronite Division of California Chemical Co, a subsidiary of Standard Oil Co of California, last month shipped the first order of packaged maleic anhydride from its new plant in Richmond, Calif.

The new plant, now completely on stream, reportedly is the first facility constructed in the West to manufacture the chemical maleic anhydride, which is used in textile wetting agents. The initial shipment of 30,000 pounds was trucked to an Oronite customer in the West. Also, several carloads of the chemical were shipped to the Eastern part of the United States for distribution to Oronite customers in that section of the country.

Maleic anhydride is a chemical intermediate produced from benzene.

Construction of the new multi-million dollar plant was started in March, 1960. The plant has the capacity to produce 20 million pounds of maleic anhydride a year, in both molten and briquette form, it is reported.

Initial trial runs of maleic anhydride in molten form have been shipped to the Ortho Division of California Chemical.

•

Virginia Smelting Changes Name

In order to reflect more accurately the nature of its business, Virginia Smelting Co has changed its name to Virginia Chemicals & Smelting Co.

The company is actively engaged in the manufacture of chemicals, refrigeration products and aerosols, which are being marketed both domestically and overseas.

New GAF Branch Office—Melrose Park, Ill

GAF Opens Expanded Chicago Branch Office

The Chemical Group, General Aniline & Film Corp, New York, NY, has announced the relocation of its Chicago Branch Office to 1950 N Hawthorne Ave, Melrose Park, Ill, effective April 15. The Branch was previously situated at 310 W Polk Street in downtown Chicago.

The new property, about 12 miles due west of the Loop and approximately five miles southeast of O'Hare Field, comprises 78,000 sq ft of land with a 35,000-sq-ft building. The building houses the office, customer-service laboratory, and warehouse serving the Chicago Branch territory. This territory covers 18 states, from the Midwest to the Rockies, and southwest including Oklahoma.

These facilities, which are under the general supervision of M Falco, branch service manager, serve all three divisions of The Chemical Group—at the direction of the respective Midwest Regional Managers, G A Brost for Antara Chemicals, T B Smock for Collway Pigments, and J L Eich for General Dyestuff Co.

In addition to the facilities listed, the new property also has four enclosed truck docks, a railroad siding for two freight cars, and an employee and customer parking lot.

•

CSMA Announces Results of Detergent Survey

Results of a comprehensive survey of industrial detergent sales have been announced by the Chemical Specialties Manufacturers Association, 50 East 41st St, New York 17, NY. They cover the years 1958 and 1959.

The Survey conducted by the Detergents and Cleaning Compounds Division of CSMA covers ten different categories of industrial detergents exclusive of products used in the household. Sixty-four companies provided data on which the figures are based.

Total 1959 sales were reported to exceed 173.6 million pounds of dry products as compared with 164.6 million pounds in 1958. Sales of liquid cleaners were reported in excess of 8.4 million gallons in 1959 against 7.3 million gallons in 1958.

With only minor exceptions all categories showed substantial sales increases in 1959 over 1958 reflecting a continuing upward trend in the use of detergents for all types of industrial cleaning.

•

KPDW Licensed to Use Curonized Trademark

Reeves Brothers, Inc, manufacturers of Curon foam, has announced that The Kenyon Piece Dye Works, Inc, Kenyon, RI is licensed to carry out Reeves' patented heat laminating process and to use the trademark Curonized when the lamination has been made with Curon foam.

The Kenyon Piece Dye Works, Inc is a commission dyer and finisher, specializing in synthetics and blends. Kenyon plans to offer quality-controlled Curonized laminates for all types of woven and knitted fabrics as an additional service to its customers.

•

SOCMA Moves Office

The Synthetic Organic Chemical Manufacturers Association of the United States has announced the removal of its office to 261 Madison Ave, New York 16, NY. The telephone remains unchanged: MUrray Hill 2-8128.

Trylon Chemical Corp's manufacturing plant at Greenville, SC

Trylon Chemical Begins Production in Greenville

Production of its complete line of textile chemicals has begun at the new Trylon Chemical Corp manufacturing plant in Greenville, SC. The new plant also houses administrative and sales offices, laboratory and warehouse facilities. The Greenville operation is the first expansion of the parent firm, Trylon Chemicals, Inc, headquartered at Lock Haven, Pa.

The new plant is located on Golden Strip Drive near Mauldin, SC. The building is of fire-proof construction, brick and steel, with air-conditioning in the laboratories and office areas. The fifteen-acre tract is served by both rail and truck transportation and reportedly affords adequate room for expansion.

Trylon Chemical Corporation produces a specialized line of textile chemical products, including fiber and yarn lubricants, antilubricants, antistatic agents, softeners and sizing adjuncts. Completion of a new ethoxylation unit not only places the company in a more basic manufacturing position but allows it to offer custom ethoxylated products (nonionic surfactants) within the textile, paper and textile specialty markets. The company feels that it is the first to offer such a service to the Southeastern market and be located therein.

Russell F Crawford Jr, formerly with Para-Chem, Inc, Philadelphia, Pa, is vice president and general manager of Trylon Chemical Corp and has taken up residence in Greenville to direct the operation.

Crawford

●

Coke, Redston Address Quebec Section, CATCC, at Silver Anniversary Meeting

Efforts to discover new man-made textile fibers are diminishing, while greater concentration is being devoted to improvement of existing man-made fibers, according to C Eugene Coke, Hartford Fibres Co, New York, who noted that this plateau had only now been reached following twenty years of aggressive and accelerated growth in both fields of improvement of existing man-made fibers, and discovery of the new.

In an address to the two-day Silver Anniversary Annual Meeting of the Canadian Association of Textile Colourists & Chemists, Quebec Section, Dr Coke, a past president of the Association, said that, although development announcements were still being made "there has been a slow-down in the introduction of new man-made fibers and there is an opinion among authorities in the field that this slow-down will continue into the foreseeable future."

In discussing current status of man-made fibers and their future, Dr Coke revealed development of "a revolutionary new man-made cellulosic staple fiber . . . aptly described as 'man-made' cotton.

"The new fiber combines most of the desirable properties of cotton and of viscose and essentially eliminates the shortcomings of both. The new fiber has the dimensional stability and good wearing qualities of natural cellulosic fibers, as well as a controlled silk-like luster. This latter characteristic is in contrast with the harsh metallic luster of bright viscose," he said.

Presenting samples of the new fabric—in corduroys, dress prints, fine suitings, and in a variety of blends with cotton and other man-made fibers—Dr Coke said that conditioned strength of the fiber is equal to that of Egyptian cotton, and that the fiber can be dyed as for cotton, and in blends with cotton, solid shades can be obtained.

In the next ten years, said Dr Coke, man-made cellulosic fiber production would be predominantly in this class.

Presentation of a later paper, J P Redston, E F Drew & Co, Inc, New York, paid tribute to the part being played in world textiles by the technologist, and the significance of Canadian textile research work in the past quarter century.

"It is with thoughts of the part played by the younger men in the industry that one sees the graduates of your St Hyacinthe, Que, and Hamilton, Ont, schools (Canada's two textile technical training institutes) as the bright new future," said Mr Redston.

CATCC's Silver Anniversary gathering was held at the Mount Royal Hotel, Montreal, Que, April 21-22 with a banquet and presentation of achievement awards to Association members.

●

Antara Chemicals Raises Prices on "R" Salts

Antara Chemicals, a Division of General Aniline & Film Corporation, New York, NY, has announced a new schedule of prices for "R Salt" as follows:

R Salt Dry	$1.11 lb—200-lb drums
	$1.08 lb—c/l or tr/l
R Salt Paste	$1.01 lb—325-lb drums
	$ .98 lb—c/l or tr/l

All prices on 100% basis, MW 348, fob shipping point minimum transportation allowed.

This new schedule reflects an increase of $0.03 lb in the drum prices and the establishment of bulk delivery prices.

"R Salts" are basic organic intermediates used in dyestuff manufacture. Their chemical structure is as follows: 2-naphthol-3,6-disulfonic acid, disodium salt.

●

National Aniline Raises Cyclohexanol Price

On April 1, Allied Chemical's National Aniline Division increased the price of its Naxol cyclohexanol two cents a pound. The increase reportedly results from the recent price increase of phenol, a basic raw material, plus increased operating costs.

National Aniline's new price schedule for Naxol cyclohexanol is as follows:

Tank Car or Tank Truck	28 cents a pound
Carload or Truckload—drums	30½ cents a pound
Less than carlots	31½ cents a pound

Shipments are made fob shipping point, minimum transportation prepaid to destinations east of Denver. For destinations west of Denver, prices for tank cars, carloads, and truckloads are 1½ cents per pound higher, and less carlots are 2½ cents per pound higher.

●

Model of W F Fancourt Co plant being built in Greensboro, NC, marks milestone in the 38-year-service tenure of Josephine Patla, corporation secretary. Miss Patla joined company in 1922 when founder Walter F Fancourt Jr was president.

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RIGID QUALITY STANDARDS...
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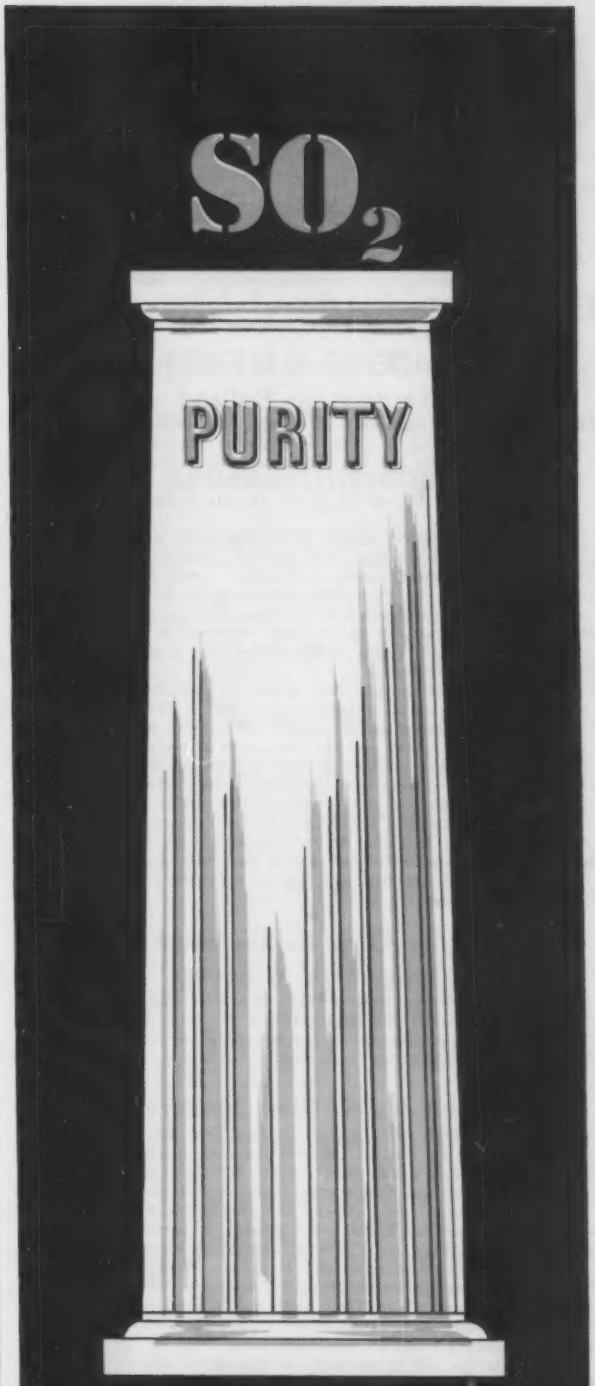

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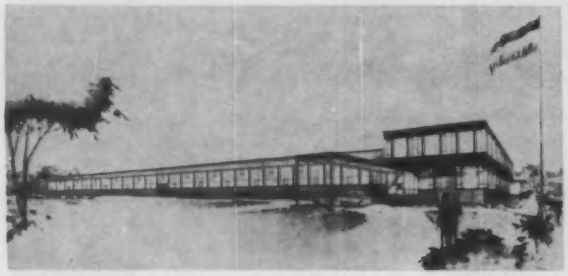

Architect's drawing of Foxboro (Nederland) NV plant in Soest, Holland

Foxboro Expands Manufacturing Facilities in Holland

The Foxboro Company, Foxboro, Mass, has announced the completion of a new instrument manufacturing and assembly building at the Foxboro (Nederland) NV plant in Soest, Holland. The new facilities, now in operation were dedicated during an Open House ceremony held on May 2.

The new structure, which gives the plant a total area of nearly 40,000 square feet, will permit a substantial increase in the production of standard Foxboro instruments supplied to industries in the European Common Market. Production of d/p Cell Transmitters will be expanded along with manufacture of pneumatic panel-type Consotrol instruments, valve motors, and basic temperature and pressure instruments, it is reported.

The new building has over 23,000 square feet of factory and warehouse space, a boiler room and a two-story office facility. The factory construction is concrete paneling with tan brick; the office portion is of brick with Dutch blue enameled asbestos-cement panels. Following the pattern of Foxboro plants throughout the world, the factory has vinyl asbestos tile flooring and ceramic tile walls.

Addition of the new building has freed space in the original plant for a training center, maintenance facilities and storage areas, and will also enable the company to increase its maintenance, repair and parts services for European instrument users.

●

Selta Corp to Represent Fabri-Mark in South

Fabri-Mark Corp, Box #7045, Roseville Sta, Newark 7, NJ, has announced the appointment of Selta Corp, Charlotte, NC, as representatives for its complete line of Fabri-Mark textile imprinting equipment.

●

Joint Nytril Fiber Venture

Plans for a new fiber manufacturing and marketing venture in Europe by two of the world's leading chemical producers have been announced jointly by Celanese Corporation of America and Farbwerke Hoechst AG of Germany.

Under an agreement between the two firms, a nytril fiber will be produced in Europe by Bobina Faserwerke GmbH and marketed there by Hoechst. Bobina is a new company jointly owned by Celanese and Hoechst. Production of the fiber will be started at facilities in Bobingen, Bavaria, during the first quarter of 1962, with plans for eventual production capacity of 32,000,000 pounds annually. The fiber will be marketed under the trademark Travis.

Darvan is the US trademark for the nytril fiber, to which Celanese heretofore had held exclusive world rights.

When European production of the nytril fiber is started, Hoechst will supply all the raw materials. A basic producer of acetic acid and vinyl acetate, Hoechst will convert these materials to chemical intermediates which it will supply to Bobina along with other components for the fiber.

The group of Hoechst fibers includes polyester and nylon 6. Celanese fibers in addition to Darvan include acetate, rayon, Arnel triacetate and Fortrel polyester.

Since acquiring world rights to the nytril fiber more than a year ago from The B F Goodrich Co, Celanese has carried on extensive research and development to overcome certain dyeing and finishing problems that initially had inhibited the fiber's market progress. The new enterprise in Europe is expected to benefit from the successful results of this activity.

Monochem, Inc Organized

The Borden Company and United States Rubber Company recently announced the formal organization of Monochem, Inc, a jointly owned company, which will construct a major chemical complex in the Baton Rouge area to convert hydrocarbons into more than a dozen chemical products.

Monochem has now been officially incorporated, it was stated, and its principal officers as well as an eight-man board of directors, have been elected. It was also announced that construction contracts have been awarded for the erection of a plant to produce acetylene and vinyl chloride monomer on an 850-acre site in Geismar, La. The plant, expected to be completed by late 1962, will cost about 25 million dollars.

Present plans call for both companies to erect adjacent individually owned plants which will use the output of the Monochem plant for the manufacture of other chemical products. Total cost of the complex will be in excess of 50 million dollars.

Earl S Ebers, a group vice president of U S Rubber in charge of the company's polymer fiber and chemical operations, has been elected president of Monochem, Inc. Augustine R Marusi, president of Borden Chemical Company and a vice president of the Borden Company, has been elected executive vice president. The presidency and executive vice presidency of Monochem will, by arrangement, be rotated annually between representatives of the two parent companies.

Monochem is expected to become an economical source of basic chemical components for the present product lines of both parent organizations. From the long-range point of view, the combined venture will provide a base for independent expansion of both companies into new chemical fields.

The initial plant, it is reported, will utimately have the capacity to produce more than 80 million pounds of acetylene and approximately 150 million pounds of vinyl chloride monomer yearly. This capacity will make it one of the largest plants of its type in the country.

●

Date Set for '62 DCAT Dinner

Thursday, March 1, 1962, has been set as the date for the 36th Annual Dinner for the Drug, Chemical and Allied Trades Association to be held at the Waldorf-Astoria. Over 1,000 reservations have already been received for this event, which is attended each year by 2,500 leaders in the drug, chemical and related fields from all over the United States.

●

Clark-Schwebel Fiber Glass Corp Starts Production

Clark-Schwebel Fiber Glass Corp has started production of glass fabrics at its new $3,500,000 fiber glass weaving and finishing plant in Anderson, SC.

This 163,000 square foot plant is said to be the first ever designed and built exclusively for glass fabrics and equipped solely with new machinery engineered specifically for fiber glass weaving and finishing. It is completely air-conditioned and humidity controlled, and located on a 20-acre site for future expansion purposes. The plant includes research and development facilities and a plastics laminate testing laboratory. It is staffed by a supervisory team consisting of widely experienced fiber glass production personnel. Total employment planned by the end of this year is approximately 400.

Clark-Schwebel reportedly will produce a complete range of fiber glass fabrics and woven glass roving for high and low pressure reinforced plastics applications such as boats, radomes, aircraft structural parts, copper-clad electrical laminates, and chemical tanks, and for high-temperature insulation, coated fabrics, electrical insulation and dust bag filtration.

Clark-Schwebel Fiber Glass Corp, organized last July, is headed by R F Clark, president, and J P Schwebel, executive vice president. Mr Clark was formerly executive vice president of Hess Goldsmith & Co, Inc, a member company of Burlington Industries, and Mr Schwebel was general sales manager of the fiber glass division of J P Stevens & Co, Inc. Warren J Rowley, former midwest manager of Hess Goldsmith, is vice president in charge of midwestern sales. Plant manager is Tyrus O Jones, former production manager of United Merchants and Manufacturers' glass weaving plant.

The company is now establishing branch sales offices and distributors throughout the country. Executive offices are at 50 Rockefeller Plaza, New York 20, NY.

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Avisco Announces Aid-to-Education Program for '61-'62

North Carolina State College and Philadelphia College of Textiles and Science will be two of more than 100 colleges and universities to benefit from the American Viscose Corporation aid-to-education program for 1961-62. $500 undergraduate scholarships will be supported for both colleges.

Gerald S Tompkins, Avisco president, stated, "As a chemical processing industry producing man-made fibers, packaging films and plastics, American Viscose Corporation recognizes the importance of advanced education, particularly in scientific research, not only to the future of the Corporation but also to the future of the nation. Therefore, it is pleased to add its support to educational institutions in the form of scholarships, fellowships, grants-in-aid and assistance through educational foundations."

Fellowships and scholarships are offered in the areas of textiles, chemistry, chemical engineering, mechanical engineering, physics, general science, cellulose, polymers and various branches relating to business administration. Recipients are selected by the schools on the basis of scholastic merit and need. The Corporation takes no part in the selection nor is the student under any obligation to American Viscose.

●

LTI Summer Program in Textiles

Five programs designed to extend professional development in textiles have been announced for the second annual summer program in textiles at Lowell Technological Institute.

Jacob K Frederick Jr has announced that enrollment is limited for each program this year and that closing date for registration in any program is May 26.

The Textile Workshop will comprise three two-week periods, Fiber and Yarn Technology from June 12 to 23, Fabric Technology from June 26 to July 7, and Dyeing and Finishing Technology and Textile Testing from July 10 to 21. Applicants may also enroll for the entire six-week workshop.

Structure and Properties of Textile Fibers will be offered June 12 to 23, mornings only, and Textile Fabrics: Types, Structure, and Identification, for the same period, afternoons only.

The Testing of Textiles will be presented June 19 to 30 and Introduction to Statistical Methods, June 12 to 23, the latter afternoons only.

Also offered in the summer professional development program is a course in Statistical Quality Control Principles, June 12 to 23, mornings only.

Further information and application forms may be obtained by writing Textile Summer Program, or LTI Summer Programs in Statistics, at Lowell Technological Institute, Lowell, Mass, attention of Prof J K Frederick.

●

NC State Short Courses for Textile Executives

A 10-day short course for executives of the textile industry will be held at North Carolina State College June 5-16.

It will be conducted by the State College School of Textiles in cooperation with the College Extension Division. Elliot B Grover, head of the Department of Textile Technology, will be in charge of instruction.

The course will be designed primarily for the nontextile college graduate now working in the textile industry at the executive level. It will be offered to help management personnel at all levels to catch up with the latest advances in textile technology.

Textile industry personnel working in such areas of production as sales, technical sales, cost, research, and training are expected to attend.

Participants will attend seven hours of lectures, demonstrations, and laboratory instruction each day. The first week of the course will be common to all participants. During the second week enrollees will be divided into two sections, one for those primarily interested in yarn manufacturing and one for those primarily interested in weaving.

A limited enrollment on a first-come, first-served basis will be accepted.

Detailed information may be obtained by contacting Extension Division, North Carolina State College, Raleigh, NC.

BUSINESS EXECUTIVE VISITS N C STATE—Harry C Mills (center), vice president and general merchandise manager for the J C Penney Co, delivered a lecture to the staff and students of the School of Textiles at North Carolina State College April 13. He stressed the opportunities and challenges in the merchandising area of the textile industry. Chatting with Mr Mills are M E Campbell (left), dean of the College's School of Textiles, and E B Grover, head of the Department of Textile Technology.

Clemson Offering Short Courses in Textiles

A series of summer short courses designed to increase the knowledge and efficiency of personnel in the textile industry and related fields begins in the Clemson College School of Textiles on June 12.

Dean Gaston Gage reminds all interested persons that advance reservations for the courses are necessary, in order that proper preparations can be made.

Courses to be offered throughout the summer, if the demand continues, include yarn manufacturing, fabric development, supervisor development, quality control, motion and time study.

Dean Gage believes that these courses will be of great value to young people who are starting a career in the textile industry. They offer a chance, he said, for people without any formal training in the various textile fields to get a basic understanding of some of them such as motion and time study and quality control.

Complete information and application forms for these courses may be obtained by writing Dean Gaston Gage, Clemson College School of Textiles, Clemson, SC.

●

PTI Name Change Official

Official approval for the change in the name of the Philadelphia Textile Institute to the Philadelphia College of Textiles and Science has been received from the Department of Public Instruction of the Commonwealth of Pennsylvania.

"The change has been made to reflect the addition of more science, general studies and business courses in its curriculum over the past ten years and to indicate the broadened interest of the College", Bertrand W Hayward, president of the institution announced.

Trustees of the erstwhile textile college recently approved a sweeping policy change to allow for the inclusion of degree programs in nontextile fields. This action was initiated on the basis of a survey of executives of top textile and allied industry firms and studies made by the education and faculty committees of the college. The changes made meet many requests from the industry for fewer processing-type courses and for more general education. However, because there is still a clear need for technically competent personnel, it was stressed that there will be no de-emphasis of courses offered in the technology of textiles.

At the same time, in support of curricular expansion and diversification, the trustees and the Alumni board of government recently adopted a new five-year development program with a goal in excess of $4,000,000. The new fund-raising effort is specifically aimed at faculty salary improvement, pension endowment fund development, accelerated amortization of the debt service on the dormitory and student union building, a 50-room women's dormitory, expanded research facilities and equipment, equipment for laboratories, as a result of the curriculum diversification, and replacement and modernization of present textile laboratory facilities.

New degree programs to be offered beginning in September, 1961, include a four-year chemistry program and a four-year pure business administration program.

REPRINTS

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The following technical articles—reprinted from recent issues of American Dyestuff Reporter—are available in limited quantity, at prices shown. Send check, money order, or stamps to address below:

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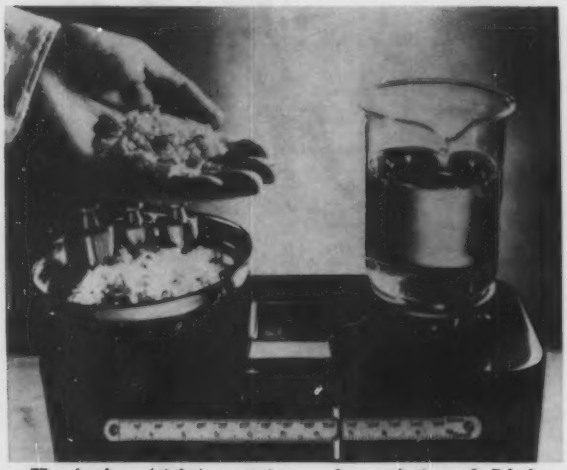

The beaker (right) contains a clear solution of Ethylose formed from the pellets (left).

Ethylose

A new industrial raw material resulting from the highly uniform grafting of an organic compound to the cellulose polymer was shown recently at the Eastern Research Division of Rayonier Inc, Whippany, NJ.

Tradenamed Ethylose, the new material, an outgrowth of the chemical cellulose producer's graft polymer program, is seen by company officials as only the first in a whole family of modified celluloses in which various chemicals and polymers are grafted onto a basic cellulose backbone.

The company is hopeful that the new material will broaden and further diversify the uses for cellulose, a readily available and easily replenishable low-cost chemical from trees. Potential markets of special interest include textiles, coated papers, paints, ceramics and foods. Rayonier Research said it foresees such immediate new products as textile sizes, binders and coatings.

R L Mitchell, general manager of research, explained that Ethylose is a high-quality, purified wood cellulose modified or grafted with a small amount of ethylene oxide to alter its behavior characteristics.

He stressed that the material is insoluble in water, but that it can readily be dissolved in aqueous alkali to render stable and useful solutions.

The amount of substitution of ethylene oxide is only 4%, Dr Mitchell declared, adding that "this is the first time an inherently soluble cellulosic bulk raw material has been commercially produced at such a low level of substitution."

It was noted that Ethylose differs from viscose in that it is stable in the small pellet form in which it is prepared as well as in solution. It reportedly can be shipped for long distances or stored for long periods without deterioration and without the need and expense of handling large quantities of water and other solvents.

Questioned as to price, Michael A Brown, general manager of sales, reported that the present price for the product was 50 cents a lb, available in 50-lb sacks.

"As the mill's production becomes established and manufacturing savings are realized, we would hope to be able to make price reductions in Ethylose," he said.

At the same time it was announced that the company had recently placed in operation a new plant at its Fernandina Beach, Fla, division for the manufacture of the new material. Dr Mitchell reported that the Ethylose plant was using a continuous, automated process employing new concepts in both reaction principles and in equipment designs. Details, he said, could not be disclosed at this time because patent coverage is being sought.

D K Smith, research manager at Whippany, together with Berwyn Thomas of Rayonier's Olympic Research Division at Shelton, Wash, and laboratory technicians demonstrated how Ethylose solutions are formed and final products produced.

At one point paper was coated shortly after the solution was prepared. Various nonwoven fabrics employing the new material as a binding agent were displayed.

Ethylose solutions were seen to be clear, even without filtration. It was explained that in many of the proposed applications for the material, a filtered solution is not essential.

A series of quick demonstrations by Dr Smith pointing up the water insolubility feature of Ethylose contrasted sharply with the water solubility of similar derivatives.

Dr Smith demonstrated that up to 8-12% Ethylose can be dissolved in a solution of 5% or more of a sodium hydroxide (NaOH) concentration. Other bases, he said, such as potassium hydroxide and lithium hydroxide can also be used. The Rayonier graft cellulose is also soluble in the common cellulosic solvents such as cuprammonium hydroxide, cuprietylene diamine, ammonium thiocyanate, sodium ferric tartrate, Cadoxen, etc. Ethylose swells slightly in quaternary ammonium compounds and is insoluble in nearly all organic solvents, as well as water.

Ethylose solutions can be adjusted to proper solids-viscosity ranges for coating, tub sizing or surface spraying. It can be regenerated by alkali removal or heat followed by washing. The particular method selected will depend on the process and end-use requirements, Dr Smith said. Neutralization can be accomplished by acid-salt solutions, such as 10% H_2SO_4 and 15% Na_2SO_4, or by acid alone. Acid-salt solutions of a dehydrating nature regenerate a product with higher density, lower gel swelling and best physical strength, he said. Temperatures in the range of 40-60°C are preferred.

●

Rubbafab

An adhesive that is said to form a permanent, flexible bond between fabric and polyurethane foam is now available from Rubba, Inc, 1015 East 173rd St, New York 60, NY.

Rubbafab, the new compound, has been extensively tested on the production line of New York and western textile firms, it is claimed, and its bonding power reportedly has been found to withstand soap-and-water launderings and drycleaning in a variety of cleaning solvents.

Used to create a weather-insulating outergarment fabric, or as padding in undergarments, Rubbafab is applied by conventional machines. It is said to provide a strong bond without the need for special heat-sealing equipment. In addition, with special applicator roll, it reportedly offers a "breathable" bond which allows the manufacturer to control the amount of air that can pass through the foam-fabric layer, from zero in the case of outergarments, to a comfortable flow in the case of brassiere cups and straps.

Rubbafab reportedly works well with natural and synthetic fibers. It also is said to adhere foam permanently to various fibers, making its use in the rug and mat field significant. The adhesive is packaged in 55-gallon drums, and in one-and five-gallon containers.

●

Pliolite VP-100

A new synthetic latex which is said to provide improved adhesion between nylon or rayon fabrics and rubber or rubberized fabric materials has been announced by the Chemical division of The Goodyear Tire & Rubber Co, Akron, O.

J E Warner, manager of the division's coatings department, said the latex, Pliolite VP-100, will be applicable to tires, conveyor belts, hose V-belts, inflatable products and tarpaulins.

Made from vinyl pyridine, styrene and butadiene, the latex is recommended by Goodyear for tire cord dips to improve adhesion between the tire fabric and rubber carcass—particularly in tubeless tires.

Mr Warner said the new latex can be used as the main ingredient in fabric dipping compounds or blended with other synthetic latices. He added that the ratio of Pliolite VP-100 to other latices can be varied to bring out the best properties in any particular application.

Pliolite VP-100 reportedly reduces cord fatigue, has improved processing characteristics and excellent mechanical, chemical and storage stability. These advantages, coupled with improved adhesion, lessen the chance of ply separation in the finished product, Warner said.

The new material is being produced at Goodyear's Akron synthetic plant and is available in tank car quantities.

ANNOUNCING 11 NEW "LATYL"* DISPERSE PASTES!!

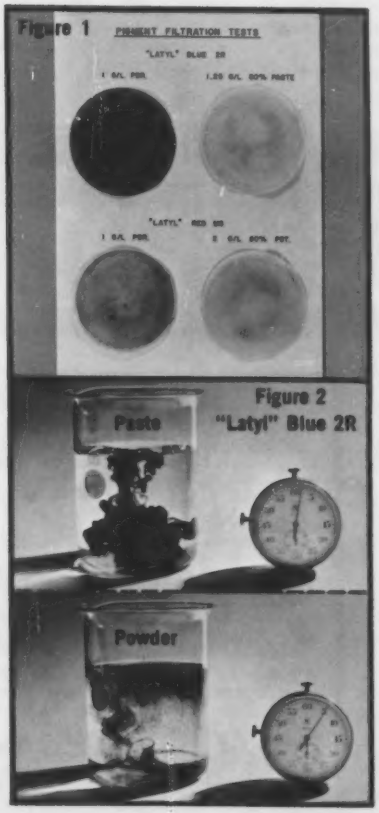

Figure 2
"Latyl" Blue 2R

A number of "Latyl" disperse dyes are now available from Du Pont in paste form and provide the dyer with a simpler route to the production of speck-free paddings on "Dacron"* polyester fiber. "Latyl" pastes are aqueous dispersions of the familiar "Latyl" powders and offer the following advantages over parent powder types: freedom from dusting, ease of preparing concentrated pad-baths in short volume, excellent redispersibility, finer particle size, improved non-specking properties.

Currently available "Latyl" pastes will produce most commercial shades. Other "Latyl" dyes are being prepared in paste form and will be available within the next few months. Those announced to date include:

"Latyl" Yellow 3G 80% Paste
"Latyl" Yellow RC 50% Paste
"Latyl" Orange NST 50% Paste
"Latyl" Brown MS 50% Paste
"Latyl" Red MG 80% Paste
"Latyl" Bordeaux B 80% Paste
"Latyl" Blue BCN 80% Paste
"Latyl" Blue LS 80% Paste
"Latyl" Blue 2R 80% Paste
"Latyl" Blue 4R 80% Paste
"Latyl" Brilliant Blue BG 80% Paste

These dyes were selected to provide a range fast to sublimation for application by the Du Pont Thermosol Process.

Extensive laboratory and mill testing has confirmed the effectiveness of the highly dispersed "Latyl" pastes. The small particle size is readily illustrated by comparing the filtrations of water dispersions of the powder type versus the corresponding paste type.

All of the "Latyl" pastes are completely and readily miscible with water. Preparation of water-based pad liquors and other short-volume aqueous dyeing media can be accomplished with greater ease since prepasting of dye with dispersing agent is eliminated. "Latyl" pastes diffuse throughout the liquor in seconds. Figure 2 shows the extremely rapid dispersion of a "Latyl" paste in water versus the comparable powder product.

If a "Latyl" paste should dry out it can be completely redispersed without noticeable loss of its outstanding non-specking characteristics. A "Latyl" paste which has dried out will wet out immediately when water is added and can be readily stirred into an excellent dispersion for padding or dyeing. Also, if the paste should dry on the sides of the container and fall back into the dispersion, the dried portion can be quickly redispersed with slight stirring.

"Latyl" pastes were developed to achieve freedom from specking in pad application of disperse dyes to "Dacron" polyester fiber.

Dyes such as "Latyl" Blue 4R 80% Paste and "Latyl" Blue 2R 80% Paste can be padded in light to pastel shades without danger of specking during Thermosol development. Therefore, a dyer has a wider range of dyes for shading purposes.

"Latyl" disperse pastes represent another Du Pont technical service to the trade. These products should contribute toward improved quality of dyeing and printing and at the same time reduce costs through reductions in processing times. "Latyl" pastes are of particular value for any application where padding is concerned, such as in the Du Pont Thermosol Process. They are also recommended for use in circulating machines for dyeing packages, stock, top, tow and in beam machines. Handling convenience and freedom from specking provide definite advantages that should be of interest to the textile printing industry.

Note: This information, based upon our testing and experience, is offered without charge as part of our service to customers. It is intended for use by persons having technical skill, at their own discretion and risk. We do not guarantee favorable results, and we assume no liability in connection with its use. This information is not intended as a license to operate under, or a recommendation to infringe, any patent of Du Pont or others covering any material or use.

*"Dacron" and "Latyl" are registered trademarks of E. I. du Pont de Nemours & Co. (Inc.), Wilmington, Del.

news from Du Pont

NEW TECHNICAL BULLETIN AVAILABLE

A new technical bulletin, *Disperse Dyes for "Dacron" Polyester Fiber and Its Blends,* is now available free. For your copy, just write E. I. du Pont de Nemours & Co. (Inc.), Dyes and Chemicals Division, N-8516-1, Wilmington 98, Delaware.

NEW "DEKATYL" VIOLET B

FOR DEEP SHADES ON "DACRON"

"Dekatyl"* Violet B is a new type cationic dye recommended for producing deep shades on "Dacron"* types 62 and 64 polyester fiber and on other fibers with affinity for cationic dyes. This new dye exhibits outstanding fastness to light and good fastness to wet processing. "Dekatyl" Violet B should be especially useful in piece dyeing blends or mixtures of "Dacron" types 64 and 62 with other fibers such as wool and the 50 series "Dacron".

Certain precautionary measures are necessary for obtaining level, well-penetrated dyeings with this dye; specific procedures can be supplied by a Du Pont technical representative.

FASTNESS PROPERTIES

On "Dacron" Type 64 with "Latyl"* Carrier A Present

Light (Fade-Ometer)	Rating	Direction of Fade
4.0% Control	6-7	M
8.0% Control	7-8	M
4.0% Heat-treated 1 min. at 400° F.	7-8	M
8.0% Heat-treated 1 min. at 400° F.	7-8	M

4.0% Dyeing on "Dacron" Type 64

	SC	A	C	D	N	R	S	W
Crocking (dry)			3					
Crocking (wet)			3					
Drycleaning ("Perclene"*) (85-60)	5-4D							
Gas-Fume Fading (3 cycles)	5-4R							
Perspiration (acid)	5-4D	5-4	5-4	—	5-4	4	4-3	5
Perspiration (alkaline)	4D	5	5-4	—	5-4	5-4	4	5
Pressing (hot dry) (1 min., 320° F.)	5-4D	—	5	5				
Pressing (hot moist) (CS 59-44)	5-4R	5	5	—	5	5	5	5
Sea Water	4D	5	5	—	5	5	4	5
Steaming (15 lbs., 30 min.)	4-3RD	5	5	—	5	5	5	5
Sublimation (dry steam, 20 min.)	4D	5	—					
Washing AATCC #3	4R	5-4	5-4	—	4	5-4	4	4
Washing AATCC #3A	4R	5-4	4	—	2	5-4	2	4

For more detailed information, see your Du Pont representative.

news from Du Pont

NEW "PONSOL"* BROWN WAB PASTE AVAILABLE FOR VAT APPLICATION

"Ponsol" Brown WAB Paste is a very economical anthraquinone vat brown. It yields bright shades and is suitable for almost all types of vat dye application.

"Ponsol" Brown WAB Paste has good working properties when reduced and dyed at 120° F. on packages and beams. This dye is not recommended for high temperature work since it becomes much weaker and duller in shade at 180° to 190° F.

"Ponsol" Brown WAB Paste produces speck-free paddings, is satisfactory for use by the vat-acid procedure, shows good uniformity in shade and strength on packages and can be printed in light shades.

FASTNESS PROPERTIES

Light (Fade-Ometer)	Rating	Direction of Fade
2.0 oz./gal. on cotton piece goods	3-4	M
4.0 oz./gal. on cotton piece goods	4	M
8.0 oz./gal. on cotton piece goods	4-5	M
16.0 oz./gal. on cotton piece goods	5-6	M

For more information, see your Du Pont representative.

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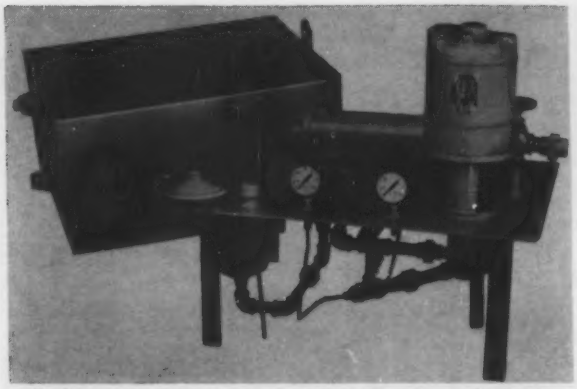


Package circulating system with cover removed showing Purolator Micronic filter element in left foreground of unit.

Filter Helps Circulator Lubricate Textile Calenders

A packaged circulating system has eliminated a critical bearing lubrication problem on calenders used in high-temperature textile-finishing operations.

Calender rolls manufactured by John Verduin Machine Corp, Paterson, NJ, for textile finishing operate at high speeds and variable pressures up to 100 tons. Since the calendar rolls operate at temperatures exceeding 420°F, the oil must be cooled prior to bearing lubrication.

Use of grease-type lubricants at such high temperatures and pressures can cause compaction of the lubricant with resultant damage to bearings and possible machine failure. For this reason, the Verduin Company now uses on all calenders a packaged continuous-flow lubricating system which incorporates a Micronic oil filter to prevent passage of abrasive particles into bearings.

The packaged lubricating system reportedly provides accurate control of lubricant temperature and oil viscosity with resultant reduction in bearing friction. Bearing life is said to be increased as operating temperatures are decreased through the dissipation of heat into the circulating lubricant.

The P-9200 series Micronic oil filter, manufactured by Purolator Products, Inc, Rahway, NJ, is said to remove all metallic particles and other foreign materials before bearings are damaged. The seven-pound filter reportedly can handle operating pressures of 75 psi and maximum temperatures of 275°F. Filtration as low as two microns is accomplished by a preformed convoluted filter element of resin-impregnated cellulose, it is claimed.

Cooled, filtered oil continually circulates through the bearings from the packaged system which is designed for accessibility to all components. The filter cover, pump motor and pressure regulating valve cap are exposed for normal service and adjustment. The filter element is removed by unscrewing the cover and inserting a new element.

Major maintenance is accomplished by removing the top plate without disturbing the system's supply and return piping. The closed, sealed unit reportedly minimizes fire hazards and contributes to on-the-job safety.

The so-called "leak-free" lubricating system, developed by Flow Equipment, Inc, 160 East Second St, Mineola, NY, handles liquids from soluble oil to 2400 SSU lubricating oil with capacities ranging from 1½ to 70 gpm.

For further information about the filtering unit, write Department 196, Purolator Products, Inc, Rahway, NJ.

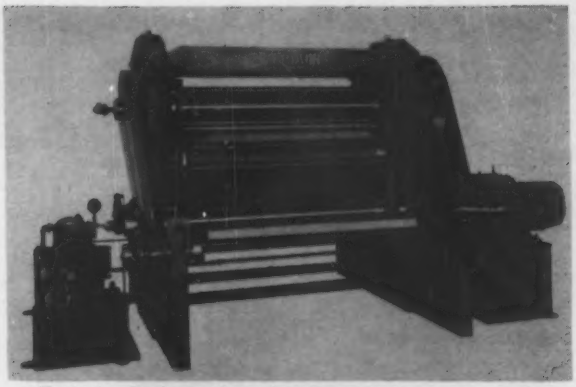
●

Nylanthrene Scarlet 2GL paf

Althouse Chemical Co, Reading, Pa, has announced the marketing of Nylanthrene Scarlet 2GL paf, an entirely new offering in its Nylanthrene series of neutral-dyeing fast colors for nylon.

The new color is much brighter in shade than previous Althouse offerings of scarlets and has superior fastness to light. The shade is said to closely approximate the bright acid-dyeing scarlets, while dyeing neutral together with far superior leveling and covering properties on the nylon to the acid-dyeing types.

The new scarlet in combination with Nylanthrene Red 4RL paf is said to be capable of formulating the majority of fashion red shades on the various nylon fabrics.



Typical calender with packaged circulating system at lower left foreground.

New Line of Fugitive Tints

Deering Milliken Research Corp, Spartanburg, SC, last month announced a new all-purpose line of tints designed for use on synthetic and natural fibers.

Covering a complete range of colors, these tints, it is claimed, offer fugitivity never available before for textile processing. The need for fugitive tints has become critical in recent years because of the development of hundreds of blends of synthetics and natural fibers that go into today's textile fabrics. Only through the use of tints have they been able to quickly and easily identify the different yarns. One of the major problems has been the removal of these tints in the finishing operation.

Patent applications have been made, and licensing agreements for the manufacture and sale of these tints have been completed. One of the firms marketing these tints will be Syn-Chem Corp of Spartanburg. Syn-Chem Corp has announced that it will sell the tints as Versatint fugitive tints.

●

Dispersol CWL

A new level dyeing assistant, Dispersol CWL, which is said to allow greater flexibility and freedom in the use of acid milling dyes, is now available through Arnold, Hoffman & Co, Inc, which claims that the new assistant cuts overall dyeing time and improves level dyeing properties. Improvement of level dyeing properties of those acid milling dyes normally considered poor in this respect reportedly permits dye combinations hitherto regarded as unsuitable. This is accomplished without reduction in light- or wetfastness, it is claimed.

Ahco states that, by incorporating Dispersol CWL in acid milling dyebaths to reduce the rate of dyeing, higher starting temperatures can be employed, resulting in shorter overall dyeing times. Further, the new assistant reportedly enables acid milling dyes to be applied under strongly acidic conditions.

Technical data is available through Arnold, Hoffman & Co, Inc, 55 Canal Street, Providence, RI.

●

New Cibacrons

Introduction of Cibacron Brilliant Red 2GP, a metal-free reactive dye, and Cibacron Blue 2R, a reactive dye that is reddish in tone, has been announced by Ciba Co, Inc, Fair Lawn, NJ.

The announcement called Cibacron Brilliant Red 2GP "outstanding for printing and pad-steam application." Also, it is of interest for the thermofix method of dyeing cellulosics and the dyeing of wool.

Besides having a "bright, full, yellowish-red shade" heretofore obtainable only with naphthols, Cibacron Brilliant Red 2GP has these additional features, the announcement said: good build-up in printing, excellent solubility, suitability for resin finishes—rubberized or coated with PVC, unfixed dye easily removed, and good stability of fiber/dye linkage to acid and alkali.

Cibacron Blue 2R is described as "the more economical of all reactive blues". It is said to build up well and can be used in combination for navies. It reportedly has good light- and wetfastness, is suitable for resin finishes, and is said to be the best reactive blue for the cold pad-batch method.

Refractosyn differential refractometer

Refractosyn Differential Refractometer

HH Controls Co, 7 Leroy Dr, Burlington, Mass, has introduced the Refractosyn Differential Refractometer for fluid-composition control of processes in the textile, chemicals and other industries. Possible control by refractive index for continuous blending of textile starch and bleach solutions is suggested.

Described as "compact, rugged, and reliable", the instrument is priced under $1,000. Its design, based on spaceship angle-sensor, reportedly operates continuously with no moving parts, no electronic tubes, and little or no maintenance.

The Refractosyn differential refractometer provides a polarized electrical output indicative of the difference in refractive index of two fluids contained in separate cavities of the instrument. Either one or both fluids may be flowing or stagnant.

Process control by refractive index is accomplished by applying the electrical output of the Refractosyn to the control of process heat-input, mixing-ratio, flow-rate, turn-off time, etc.

Visual reading of the refractive-index difference may be obtained by manually rotating one of the indicator movements (either *coarse* or *fine*) until the enclosed meter is nulled. The RI difference is then read from the indicator scale. The visual reading is used for analysis in the laboratory or for monitoring processes.

A bulletin listing the nominal specifications of the instrument is available from the manufacturer as is an applications note, discussing control by refractive index.

•

Improved Arquad 2HT

Armour Industrial Chemical Co, Chicago, Ill, has announced production of a whiter quaternary ammonium chloride for use in formulating industrial softeners and laundry rinses.

Tradenamed Arquad 2HT, the whiter product retains all the performance characteristics supplied by Arquad 2HT originally.

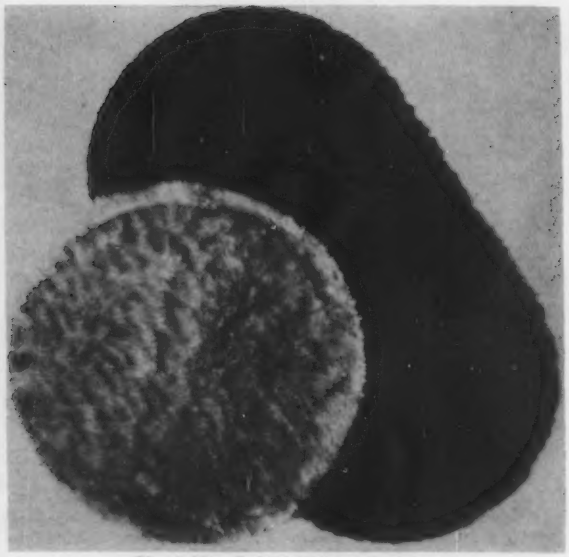
Arquad 2HT reportedly is used to fluff fabrics, speed drying, ease ironing, reduce wrinkling, and eliminate uncomfortable garment cling.

•

Cloud No. 9

A new scatter rug is being manufactured by the Pile Fabrics Division of Collins & Aikman Corp from a blend of American Cyanamid's Creslan acrylic and Union Carbide's Dynel modacrylic fibers in a 60-40 proportion.

Cloud No. 9 is of a high pile and is said to be washable in warm water in a washing machine or by hand, with neither shrinkage nor alteration in appearance. Its other qualities, and the relation of its component fibers to these, have been pointed out by James Clohessy, sales manager for the Rug and Carpet Department of the Division.



Cloud No. 9 high-pile scatter rug

He has indicated that, because acrylic fibers do not absorb water, Cloud No. 9 dries quickly, and can even, he has suggested, be hung to drip-dry overnight. Its silky texture is lent to the rug by the use of Dynel, he has submitted, adding also that the ability of Creslan and Dynel to take dyes easily accounts for the range and quality of the colors of the new rug.

Cloud No. 9 is available in 20 colors, from "Cloud White" to "Eclipse Black", and in 17 sizes in round, oval and oblong shapes. Its price range, beginning at $2.90 on a wholesale, or $4.95 on a suggested retail level, for a 24" round or an 18" × 30" oval rug, extends to $97.75 wholesale for a 9' ×15' rug. Lid covers to match rugs for bathroom use wholesale at $1.50.

•

New Supralans

General Dyestuff Co, a Division of General Aniline & Film Corp, has announced the addition of two new fast-color dyes to its Supralan range—Supralan Black GGL-CF and Supralan Brown RB-CF.

Supralan Black GGF-CF is said to supplement its companion color, Supralan Black NB-CF, in offering related clean black and gray shades on wool, silk, nylon and other synthetic fibers, including Creslan, Dynel, Verel and Zefran. These neutral-dyeing, metallized acid colors are said to feature economy in full shades and a direct dyeing cycle with maximum fiber protection. Dyeing and fastness properties of the two blacks are virtually alike, the main difference being in cast of shade. Supralan Black GGL-CF is somewhat the greener and jetter of the two, especially under incandescent lighting. Both can be applied in self or fashion shades by regular methods currently in use for applying neutral-metallized colors. Shade fastness is in keeping with the Supralan dyes.

Supralan Brown RB-CF is a neutral-dyeing metallized acid dyestuff offering a bright medium brown shade on wool, silk, nylon, acrylic and modacrylic fibers. As the newest member of the company's Supralan dye series, this versatile color reportedly meets the standards of the group in its good dyeing and shade fastness properties. Supralan Brown RB-CF is applied by direct procedures to wool, silk and spun synthetic fibers, either as raw stock, slubbing, yarns, or piece goods. The dye's features are said to be its very good fastness to light and to wet treatments, the latter quality providing shade stability in subsequent wet processing and in laundering. It is said to be extremely well suited for dyeing full, rich self shades of chocolate brown, or in combination with other Supralan dyes for producing taupes, tans, and cordovans for many end uses such as upholstery, carpeting and apparel fabrics.

Additional information on shades, working properties, uses, applications and fastness properties may be obtained from General Dyestuff Co, 435 Hudson Street, New York, NY.

Moretex the Rx of Chemicals

Like a doctor's prescription, Moretex Chemicals are held to rigid standards of purity. Laboratory research is constantly seeking ways in which to improve existing formulae and develop new ones for the fast growing array of fibers.

APPLICATION	PRODUCT NAME	CHEMICAL NATURE
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	BINDER X	CHITOSAN ACETATE
ANTICROCK	MOROPOL X-105	AQUEOUS POLYETHYLENE EMULSION
BLEACHING ASSISTANT	SULFONATED CASTOR OIL	50% AND 75% SULFONATED CASTOR OIL
CHELATING AGENT (Fe, Al)	MORENE S	POLYHYDROXY CARBOHYDRATE
CHELATING AGENT (General)	MORENE 30	SODIUM SALT OF ETHYLENE DIAMINE TETRA ACETIC ACID
EMULSIFIER	MOROSOL SL	POLYOXYETHYLENE SORBITAN STEARATE
DYE FIXATIVE	MOREPEL RW	AQUEOUS DISPERSION OF PARAFFIN & ALUMINUM ACETATE
FINISHES		
BODYING AGENT	MOROLUBE H61	ANIONIC FATTY ESTER EMULSION
CRUSH RESISTANT (Durable)	MOROPOL 700 600	AQUEOUS POLYETHYLENE EMULSION
EMBOSSING & GLAZING	MOROPOL 700	AQUEOUS NONIONIC POLYETHYLENE EMULSION
SEWABILITY FINISH	MOROLUBE GW	AQUEOUS NONIONIC HYDROCARBON EMULSION
SHRINKAGE CONTROL	KYLAN	DEACETYLATED CHITIN
SOFTENERS		
CATIONIC	MORAMINE C	FATTY ACID AMIDE—ACETIC ACID SALT
KNITTING	MOROPOL 600	NONIONIC POLYETHYLENE EMULSION
NAPPING		
SOFT	MORAMINE NS	MIXED FATTY SULFONATES & AMIDES
FULL BODY	MORAFIN 61	ANIONIC DISPERSION OF FATTY ACID ESTERS
SCROOP	MOROFIN AD	ANIONIC DISPERSION OF FATTY ACID ESTERS
NON SOIL RETENTIVE (Durable)	MOROPOL 762	DISPERSION OF GLYCERIDIC EPOXYDIZED OIL
WASH & WEAR (Durable)	MOROPOL 700, 762	NONIONIC EMULSION OF DURABLE RESIN PLASTICIZERS
LUBRICANT (Yarn)	MOROLUBE BA	NONIONIC LIQUID EMULSION OF SATURATED HYDROCARBON
PENETRANTS	MOROWET DC70, DC25	SODIUM SALTS OF DIOCTYL SULFOSUCCINATE
DYEING	MERCERIZER ASS'T.	CRESYLIC BASED PENETRANT
MERCERIZING	MOROWET LF	SULFONATED BUTYL OLEATE (Sodium Salt)
REWETTING	MOROSOL 4L	PEG 400 MONOLAURATE
PLASTICIZER & DISPERSANT		
SIZING	MORETEX 70	MIXTURE OF WATER INSOLUBLE
COTTON	MORETEX 85	MIXTURE OF WATER DISPERSIBLE FATTY ACID AND FATTY GLYCERIDE DERIVATIVES
SYNTHETICS		
WATER REPELLENT	MOREPEL RW	AQUEOUS DISPERSION OF PARAFFIN AND ALUMINUM ACETATE

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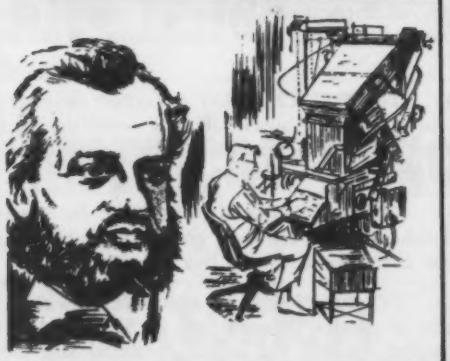

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D-27

CLASSIFIED ADVERTISEMENTS

Advertisements in this section are restricted to HELP WANTED — POSITION WANTED — EQUIPMENT wanted or for sale. Rates, effective February 1, 1951; One-time, $14.00 per column inch; 13 or more times, $12.00 per column inch: Position Wanted, $4.00 per column inch. Figure 38 average words per column inch. Publisher reserves the right to reject or discontinue any classified advertisement. Replies should be addressed: Box Number ..... c/o American Dyestuff Reporter, 44 East 23rd Street, New York 10, N. Y.

• SERVICES •

ABSTRACTING SERVICES—Abstracting and digesting of foreign patents and periodicals. Literature review and special reports in dyestuff and cellulose chemistry. PAUL WENGRAF, 88-36 ELMHURST AVENUE, ELMHURST 73, NEW YORK

• EQUIPMENT WANTED •

LABORATORY EQUIPMENT WANTED: Ager, beaker dyebath, stainless steel beakers print machine, glassware, scales and other laboratory utensils. Please submit details and your telephone. Write Box No. 162

• OPPORTUNITIES AVAILABLE •

CAREER OPPORTUNITY—for recent textile school or textile chemistry graduate age 21-24. The man we are looking for should have a friendly, outgoing personality and be interested in the idea of a sales career—even though he may not be heading in that direction now. Thorough training program, good salary and benefits, excellent growth possibilities—New York area. Replies held in strictest confidence. Our employees know of this advertisement. Write Box No. 141

WANTED: CHEMIST FOR TEXTILE CHEMICAL SPECIALTY MANUFACTURER. Must have experience in analysis and development. Excellent opportunity with progressive company. Salary commensurate with experience and ability. Write Box No. 154

WANTED: TEXTILE DEVELOPMENT CHEMIST—$10,000-$12,000. Opportunity to head textile development group of national chemical company. Require 5-10 years experience in textile field—background in polymer chemistry desirable. Ceneral New Jersey labs. Write education, experience in detail. Write Box No. 157

• OPPORTUNITIES AVAILABLE •

WANTED: CHEMIST—with thorough scientific background for successful cotton finishing plant in New England. Excellent opportunity. Send detailed resume, including salary requirements. Write Box No. 163

WANTED: TEXTILE CHEMIST with MILL EXPERIENCE—Rohm & Haas Research Division at Philadelphia has an attractive opportunity for an alert chemist to use ingenuity and mill experience. Position carries responsibility for solving customer problems in our textile chemicals product development and sales service laboratory. Must have BS or MS in chemistry or textile chemistry with one to four years mill experience particularly in finishing. All replies will be treated in confidence. Write giving full details of training, experience and salary to: ROHM & HAAS COMPANY, OTE—#2, Box 219, Bristol, Pa.

WANTED: COLORIST IN DYE APPLICATIONS LABORATORY of dyestuff manufacturer located in the Metropolitan-New York area. Require 5-10 years experience in all types of applications, degree not essential. Send detailed resume including salary requirements. Write Box No. 164

WANTED: TEXTILE CHEMIST to become assistant to dyemaster in a dyehouse specializing in skein dyeing of orlon, worsted yarn and blends; staple dyeing and bleaching of specialty fibers. Write Box No. 165

WANTED: EXPERIENCED SUPERVISOR for processing and finishing of tubular knit goods. Evenutal placement will be in the South. Write Box No. 166

WANTED: YOUNG TEXTILE ENGINEER with selling abilities if possible brought up in South America. Speaking perfect Spanish and English prefered also German. To start with an agency of worldknown suppliers of dyestuffs and textile machinery. Please send application to: Apartado, 2760 Caracas, Venezuela.

• PERSONNEL AVAILABLE •

POSITION WANTED: TEXTILE CHEMIST OR COLORIST. B. S. Textile chemistry and dyeing—36 years of age, single. 10 years experience dyeing and printing (roller and screen). Desire position as textile chemist or colorist. Excellent references. Write Box No. 142

POSITION WANTED: Responsible administrative position with Dyestuff Manufacturer or Jobber. Considerable experience in front office management. Excellent liaison between production and sales. Exceptional technical background, fully qualified to assist top level executive. Write Box No. 156

POSITION WANTED: PLANT MANAGER—Experience in managing Print Works and Dyeing and Finishing Plants. Specializing in synthetics, cottons and silk. Will send resume on request. Write Box No. 158

POSITION WANTED: MAN WITH EXECUTIVE ABILITY and twenty years experience in textiles both in North and South America, seeks position overseas or in Latin America as superintendent of dyeing and finishing on synthetics and blends. Excellent references. Speak English, French and some Spanish. Write Box No. 159

POSITION WANTED: QUALIFIED EXPORT EXECUTIVE AVAILABLE—Chemist trained by internationally known dyestuff producer. Mature, conversant dyestuff, pigments, chemical lines. Interested foreign or domestic field. Write Box No. 160

POSITION WANTED: TEXTILE CHEMIST, DYER AND FINISHER experienced (10 years) on all type fibers and blends seeking a position in Technical service or head dyer. Will relocate. Write Box No. 161

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PERSONALITIES IN THE NEWS

Wich

Senesac

Rendino

Weiss

Hurlimann

Emil A Wich, formerly manager—technical service, has been appointed to the position of manager—technical service and development at Collway Pigments Division of General Aniline & Film Corp, New York, NY. He will report to *R C Hyatt*, director of marketing of the Division, and will be responsible for technical service, as well as sales and product development of present product lines.

Melvin Hoyt has joined the Commercial Development Department of GAF's Chemical Group as a market development engineer. Mr Hoyt was previously sales manager of Abbey Chemical Corp.

●

Ernest-John Solvay, chairman, Solvay & Cie, and chairman of the board, National Research Foundation of Belgium, was the recipient of the first International Palladium Medal at a dinner held April 20th at the Waldorf-Astoria.

The Medal, established this year by the American Section of the Societe de Chimie Industrielle, Inc is given in recognition of outstanding contributions to international understanding and friendship among free nations through the exchange of technical information and products of chemistry.

●

The Cravenette Co, USA, South Hackensack, NJ (Division of Crown Chemical Corp, Providence, RI), has announced that *J M Senesac* has joined the company's sales promotion department. His efforts will be concentrated in the knitwear field.

Mr Senesac has been with Warwick Chemical Co for the past three years.

●

C Charles Rendino has joined the Textile Industries Sales Division at the home office of The Foxboro Co, Foxboro, Mass. Rendino brings Foxboro over ten years' experience in the textile industry. He was formerly associated with the Sayles Finishing Co of Rhode Island where he was superintendent of wet processing and finishing.

●

Robert E Vidal has been named manager of the Greensboro Division of Dow Corning Corp, Midland, Mich, effective immediately.

The Company states that the recent growth of the Greensboro operations makes a single overall manager desirable. The textile emulsion plant, the silicone specialties manufacturing and sales and the product engineering laboratories, all in Greensboro, will be administered by Mr Vidal, who will coordinate them with the activities in Midland. He will be responsible to *A W Rhodes* of Midland.

Mr Vidal has been manager of resin sales for Dow Corning since 1957.

●

J G Soroka, president, Fabric Dyers Ltd, has been re-elected president, the Canadian Association of Textile Colourists & Chemists, Quebec Section, for a second term. *S H Chambers*, The Montreal Cottons Ltd, remains as honorary president.

Vice presidents for the coming season are *J H Lowe*, BASF Canada Ltd, and *C R Teichgraber*, Domil Ltd, while *T R Owen*, Hart Products Ltd, was re-named secretary, and *D Heggie*, Ayers Ltd, treasurer.

Association Councillors are: *P W Benn*, Duplan Dyeing Co Ltd; *F Martin*, Canadian Celanese Ltd; *K Hogan*, Commercial Dyers & Bleachers Ltd; *A G Plumb*, Ciba Co Ltd; *A Zinnator*, Du Pont of Canada Ltd; and *F J Deegan*, Ciba Co Ltd.

Arol Chemical Products Co, 371 Wayne St, Jersey City 2, NJ, has announced the appointment of *J Jack Weiss* as technical director.

Mr Weiss was formerly associated with Emkay Chemical Co, Elizabeth, NJ, as chief chemist.

●

Conrad G Hurlimann has joined Geigy Chemical Corp as vice president and director. He will assist at the planning and management level in the company's general expansion and growth.

Before his affiliation with Geigy, Mr Hurlimann was, for several years, administrative vice president and director of Pfizer International, Inc.

●

R D Bennett, Du Pont of Canada Ltd, has been elected president, The Institute of Textile Science, replacing *R V V Nicholls*, McGill University.

D R Muir, Johnson & Johnson Ltd, was named vice president, while *R W Kolb*, Dominion Textile Co Ltd, was elected treasurer. *G A Young*, Canadian Industries Ltd, was named secretary.

Institute directors for the coming year are: *H C Mersereau*, Canadian Celanese Ltd; *Alec C Jones*, Department of National Defence; *M L Staples*, Ontario Research Foundation; and *S J Hungerford*, Du Pont of Canada Ltd.

●

James B Griffin, general superintendent of Waverly Mills, Inc, Laurinburg, NC, was named "Man of the Year" by the North Carolina State College Chapter of Phi Psi, professional textile fraternity, at the group's annual banquet held April 14 in the Steak House in Raleigh. He was cited as the textile executive in North Carolina who has made the most significant contributions to the textile industry during the past year.

●

Charles J Geyer has been named manufacturing and technical director of the Fibers Division of American Viscose Corporation, effective May 1. In this position, Mr Geyer assumes the duties of manufacturing supervision formerly handled by *Paul E Hill*, who retired last month, in addition to his former responsibilities as division technical director.

●

N J Mohoruk, The Hamilton Cotton Company Ltd, has been elected to head the National Council of the Canadian Association of Textile Colourists & Chemists. Retiring President is *John Dean*, Canadian Celanese Ltd.

At the Council's Annual Meeting, *J G Soroka*, Fabric Dyers Ltd, was named vice president.

OBITUARY

JOHN SNOOP, seventy-five, technical adviser for the last fifteen years to the textile chemical firm of Morningstar-Paisley, Inc, New York, NY, died recently. Mr Snoop, who was a native of the Netherlands, had been in the textile industry in this country for forty-five years.

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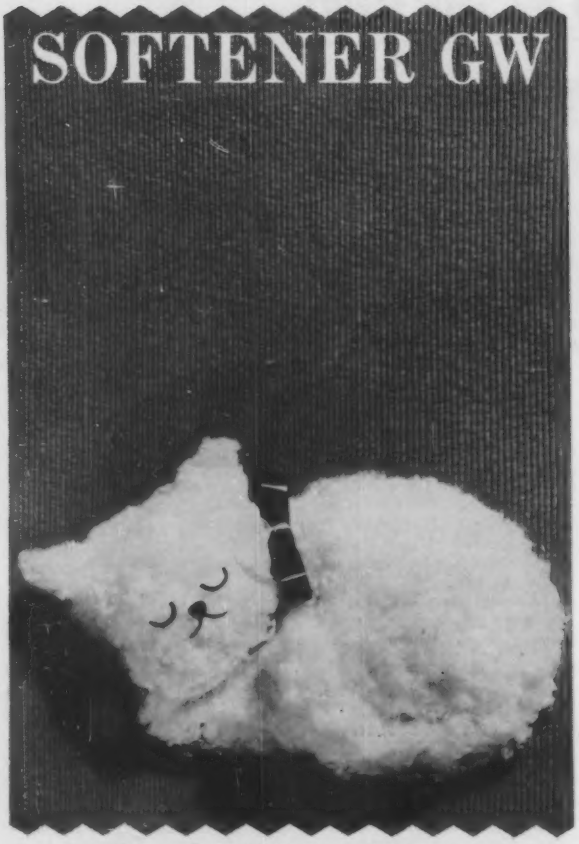

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Colored Sheet Sales Climb In Retail Stores

Consumer preference for colored sheets and pillow cases is definitely moving from single gift and impulse buying to planned, multiple-purchases of colored "bedding wardrobes" for the consumer's own home. This lively trend is recorded in 1960 and is continuing into '61 sales figures. Colored merchandise accounts for an increasingly large proportion of retail sales.

With overall sales in 1960 showing only modest gains, the sizeable increase in dollar volume from colored sheets sweetened the entire picture. It is fair to conclude that without color to stimulate extra sales many stores would have recorded a minus instead of a plus compared with previous years.

The greatest sales increases of colored merchandise invariably are related to the stores' own emphasis on color in advertising, promotion and departmental displays. This bears out the conviction that consumers are more than ready to buy color, and that promotion of colored merchandise pays off.

Decorators and growing members of "do-it-yourself" color experts are using the great decorative potential of colored bedding. Store buyers are recognizing the great sales potential in colored bedding.

American Cyanamid Company, through its activity in the Vat Dye Institute and independent promotion and advertising efforts, is happy to encourage this upward trend to color. It brings more beauty into the home and more business to everybody in the trade.

Calcofast* Salt Solution Speeds Level Wool Dyeing

Calcofast Wool Dyes are acid-insensitive metalized dyes. Repeated studies and experience have shown that these dyes level best when the ending pH is in the range of 1.5 to 2.0, using about 8% sulfuric acid (o.w.f.) at a liquor ratio of 1/40. Baths containing 20% of 85% formic acid (o.w.f.), phosphoric or glacial acetic acid do not produce the same fiber levelness even though the dyeing is boiled for two to three hours. Apparently, sulfuric acid at this concentration has a unique effect upon these dyes and the wools fiber—it promotes comparatively rapid and level absorption and desorption of dye during the boiling period. Such high concentrations, however, may also produce serious disadvantages: loss of tensile strength in the dyed wool, damage to stainless steel or other metallic equipment, further loss of tensile strength when the yarns or fabrics are re-dyed in a strongly acid bath.

In an effort to minimize the adverse effects of 8% sulfuric acid on the wool and equipment many dyers have reduced the sulfuric acid to 5%. However, such a reduction does not produce fiber levelness.

To help dyers retain the level-dyeing benefits of sulfuric acid without negative side effects, the Cyanamid Dyes Department at Bound Brook undertook an intensive study to solve the problem. Result of this research project is a Calcofast Salt which helps produce good level dyeings with a much lower concentration of sulfuric acid.

Extensive microscopical studies show that adding 1% to 2% Calcofast Salt Solution reduces time at the boil required for leveling by one-third to one-half.

Figure 1 shows a cross-section of a dyeing after one hour at the boil in a bath containing 5% sulfuric acid. Figure 2 shows a cross-section of a duplicate dyeing with the addition of 2% Calcofast Salt Solution in the bath. Note the uniform distribution of dye in Figure 2 as compared with the uneven distribution in Figure 1.

Other tests show that increased depth in medium to dark shades can save more than enough dye to pay for the cost of the Calcofast Salt Solution. For example:

A 3% dyeing of Calcofast Wool Bordeaux RB Conc. on worsted yarn, using 5% sulfuric acid to exhaust, can be equalled in depth with 2.4% of the same dye, using 5% sulfuric acid and 2% Calcofast Salt Solution.

*Trademark

Calcofast Wool Bordeaux RB Conc. sells for $4.31*; Calcofast Salt Solution for 67¢* per pound.

$ 4.31 cost of dye
3% dyeing
$12.93 cost of dye alone

$ 4.31 cost of dye
2.4% dyeing
$10.34 cost of dye
1.34 cost of 2% Calcofast Salt
$11.68

The difference pays for the Calcofast Salt Solution, with $1.25 left over.

Although this saving is important, the major advantages of using Calcofast Salt Solution are *reduced boiling time, brighter, more level shades, higher tensile strength of wool yarns.*

Samples and technical data on request.

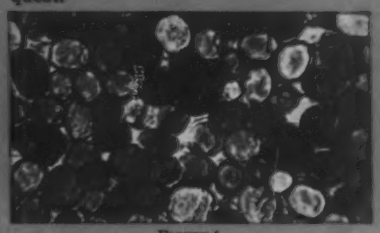

FIGURE 1

0.75% Calcofast Wool Yellow N
0.75% Calcofast Wool Orange RN
0.75% Calcofast Wool Pink N
0.75% Calcofast Wool Blue 2G
5.00% Sulfuric acid conc.

Raised to the boil and boiled 1 hour. Note the non-uniform distribution of dye. Some fibers are undyed while others are lightly and heavily dyes.

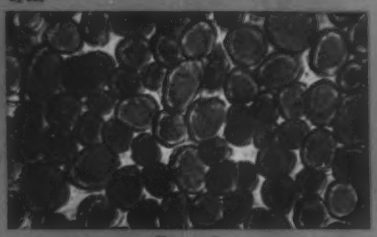

FIGURE 2

0.75% Calcofast Wool Yellow N
0.75% Calcofast Wool Orange RN
0.75% Calcofast Wool Pink N
0.75% Calcofast Wool Blue 2G
5.00% Sulfuric acid conc.
2.00% Calcofast Salt Solution

Raised to the boil and boiled 1 hour. Note the comparatively uniform distribution of dye among all of the fibers. Note the absence of undyed or lightly dyed fibers. This cross-section shows the absence of undyed or lightly dyed fibers so prevalent in Figure 1.

*As of 2-11-61